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Editor
C. M. POULSEN

Managing Editor
G. GEOFFREY SMITH, M.S.I.

Chief Photographer
JOHN YOXALL

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The Outlook

The Right to Think

EVERYONE was doubtless pleased to see in the Birthday Honours that Actg. Air Marshal A. T. Harris, A.O.C.-in-C., Bomber Command, has been made a Knight Commander of the Bath. The grand organisation of the raids on Augsburg, Lübeck, Rostock, Cologne and Essen has been ample justification for golden spurs.

The pleasure felt at this particular honour makes it all the more regrettable that in a recorded talk for a film Sir Arthur should have said: "A lot of people (generally those with no qualifications to speak, if to think) are in the habit of iterating the silly phrase, 'Bombing can never win a war.' Well, we shall see."

It always seems to us deplorable when a debater points his argument with a charge or an innuendo that those who differ from him are mentally deficient. Sir Arthur may prove quite right in his opinion; as he says, we shall see. But are those who hold the opposite opinion generally unqualified to speak or even to think on the subject? Let us consider some instances.

Lord Trenchard made a speech in the House of Lords on January 28th last, in the course of which he was reported to have said that the air must dominate strategy. "He did not mean that air could win the war without the Army and the Navy. *It could not* (our italics), but it must dominate strategy." The noble Viscount did not use the term "bombing," but he can hardly have meant anything else by his use of the words "the air."

Admiral Sir Andrew Cunningham on May 26th gave a review of his command in the Mediterranean, and remarked: "The ultimate victory in war, let there be no mistake, is won by the foot-slogging soldier in his thousands. . . ." and he went on to describe how sea power was essential for that climax, and that "an indispensable ingredient of sea power in modern war is the air."

Surely those two officers are qualified to think and to speak.

Commissions for Air Crews

THE Canadian Air Minister, Major the Hon. C. G. Power, has been stating, in the Canadian House of Commons, his opinion that all qualified members of air crews should be granted commissions. He said that all men who had graduated under the Empire Training Plan went overseas to serve under the Royal Air Force, and he attributed the reluctance to grant commissions to all of them to the unwillingness of the Treasury in Great Britain to pay commissioned rates where it could pay less. He met with considerable support from Members in the House.

It seems ungracious to argue that highly trained men like navigators and wireless operators, men who are doing daring and dangerous work in carrying the war into Germany, should not receive every reward which a grateful country and Empire could give them, but there are abiding principles which ought not to be overwhelmed by the enthusiasms of the moment.

The Royal Air Force is not the only Service which has highly trained men doing dangerous and valuable work. It would perhaps not be much of an exaggeration to say that what is true of an air crew is also true of engine-room artificers in the Royal Navy or sergeant majors of sappers in the Corps of Royal Engineers. In this

war of machines, there have to be highly trained men in many positions, many of them doing dangerous work, and they cannot all be commissioned.

An even stronger reason for setting a limit is to be found if one looks forward to the coming days of peace. Then, of course, there will not be so many Canadians in the Royal Air Force, but the Royal Canadian Air Force will continue to exist and to develop in its own way. If the Government of Canada chooses to advise the King to grant a commission to every member of an air crew, that is its own affair. As regards the Royal Air Force, we think such a policy would be wrong. It would tend to perpetuate and extend the system of short-service commissions, which we have always believed to have grave drawbacks. It throws a lot of officers out into the world after a few years in the Service.

There is no chance at all that the R.A.F. can provide careers as officers for all the pilots, observers, etc., which are needed to keep the aircraft in the air. Only the comparatively small number who have been granted permanent commissions through Cranwell or a university can expect to rise to high rank in the Service. The obvious solution of this problem is to rely mainly on airmen to provide the bulk of the pilots and air crews, keeping the number of officers down as nearly as possible to those who hold permanent commissions. Of course, some airmen are granted commissions (as happens in all the Services) and such commissions are permanent; but the practical abolition of airmen pilots and airmen observers would not be for the good of the Service.

The Set-back in Libya

THE British defeat in Libya is galling. At the beginning of the campaign we were all assured that the Empire had air superiority, though it is not certain that this was maintained to the end. The public will want to know why, when the Axis has air superiority, it wins a campaign, but when the British hold that advantage the result is different.

This was a tank campaign, and the R.A.F., despite the grand work of the air crews and ground staffs, could not nullify Rommel's superiority in that arm. Frankly, it did not try to do so, but concentrated on his lines of supply. If our ground troops are outmatched, air superiority will not always spell victory.

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A sunset study of the aircraft carrier H.M.S. *Illustrious* at sea. Fairey Swordfishes are making their final circles of the ship before landing on.

War in the Air

The Convoy Battles : A Set-back in Libya : Rumanian Oilfields Bombed : A Flight Over Paris

GETTING convoys through the Mediterranean is now a very ticklish business, but Malta and Libya had to be kept supplied. Malta does not grow enough food to feed her small population, now swollen by a wartime garrison, and that garrison expends an appalling number of shells and uses up very large quantities of fuel and aircraft ammunition. She must never be allowed to run short, and the ships which bring her supplies have to come through the Straits of Gibraltar and the Sicilian Narrows, past the troublesome little island of Pantellaria. There is no chance of their escaping the notice of the Axis reconnaissance aircraft, and so the escort has to fight its way through in the teeth of attacks from sea and air. Tobruk was expected to stand another seige, and so supplies were sent from Alexandria.

In the second week in June two convoys steamed out simultaneously for the two places, and both were heavily attacked by the Italian Navy and by Axis aircraft. The Italians sent out a force which included two battleships and at least one heavy 10,000-ton eight-inch-gun cruiser of the *Trento* class, to the south of Taranto. Apparently this force was hoping to destroy the very large convoy bound for Tobruk. The Italian fleet was sighted on the evening of June 14th by one of our reconnaissance aircraft, and was promptly attacked by long-range torpedo machines, but the results were not observed. Next day our torpedo aircraft from Malta and Africa set out to deal with the Italian ships, and Liberator bombers, mostly flown by American crews, joined in. A combination of high-level bombing and low-level torpedo attacks is the most effectual way in which aircraft can deal with warships. One of the Italian cruisers of the *Trento* class was set on fire by bombs and was sunk by air torpedoes. A smaller cruiser and a destroyer were also hit. The Italian fleet then turned away, and left the attack on the convoy to the Axis air forces.

They used every sort of dodge at their disposal, of course including dive-bombing. Apparently only one merchant ship was sunk by the air attacks, and most of the crew were picked up by another ship. The convoy got through to Tobruk, and the Italian Navy now has only one heavy cruiser left. The American War Department has stated that the Italian battleships *Littorio* and *Cavour* were hit by U.S. aircraft. The British claim was that two battleships had been set on fire by R.A.F. torpedo aircraft and U.S. bombers. Both these ships had been torpedoed at Taranto in 1940.

The Malta Convoy

ON the same morning, June 15th, the second Italian naval force was found near Pantellaria, evidently hoping to gobble up the convoy from Gibraltar. There naval aircraft and R.A.F. machines combined to attack it, and the British escort included some heavy units. One Italian cruiser

DEFEATING THE U-BOAT (1): A sequence of four photographs of a German submarine being destroyed by a Whitley in the Bay of Biscay. In the two upper pictures, the tailwheel of the Whitley is visible.

DEFEATING THE U-BOAT (2): Aircrews which have been trained in Canada and flown to this country in aircraft being delivered from America.

WAR IN THE AIR

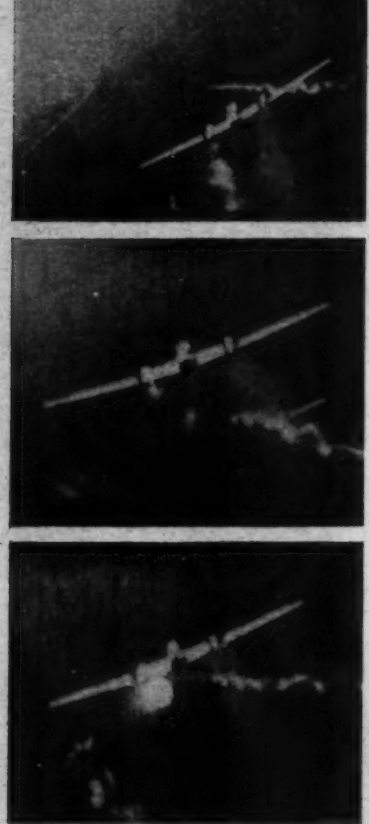
was hit and set on fire, and it is believed that a destroyer was also hit. The fighting was not all in the air, for our ships did some damage, too. That convoy got through to Malta.

The fighting lasted for four days altogether, and there were numerous tough battles in the air.

On one occasion our fighters intercepted a large force of 40 dive-bombers (Ju 87 and 88) and forced them to jettison their bombs, far away from our ships.

Considerable numbers of enemy aircraft were destroyed during these operations, though the precise tally could not be calculated at once. It has been admitted that there were shipping losses on our side, but the enemy has not been told what they were, and accordingly the British public has also been left in the dark.

Some few days ago a sensation was caused by the forced landing of four Liberators with American crews in Turkey, because of their having run out of petrol. The story of their adventures has now been released. On June 11th fifteen of these bombers set out from Egypt and arrived over Rumania before dawn next day. The Germans and Rumanians were taken by surprise, and the opposition put up was negligible. When it grew light the Liberators took deliberate aim and bombed targets in the oilfield at Ploesti. Then they started back, but German fighters found them over the Black Sea and shot one down. Ten arrived back in Allied territory, though not unscathed. Four ran short of fuel and had to land in Turkey. One had been shot about and three of its crew were slightly wounded. The Turks are treating the 28 American airmen very hospitably, though they have to intern them. The damage done at Ploesti is said to have been most satisfactory, and the moral effect of the raid was considerable.



THE END OF AN ME 110: Cine pictures taken by a camera synchronised to operate with a fighter's guns. From the top downwards: The Me tries to get away by going flat out. Tracer bullets a little high. A hit on the port engine. Further hits on the port engine and it bursts into flames.

REFUELLING THE CREW: Taking provisions aboard a Short Sunderland in the Mediterranean.

A Jeu d'Esprit

A LITTLE bravado often cheers up spirits in time of war, and the "V"-loving people of Paris must have been immensely brightened when on one day last week Flt. Lt. A. K. Gatward and Sergt. Fern flew a Coastal Beaufighter low over the roof-tops of Paris in broad daylight, and dropped Tricolour flags on the Arc de Triomph and the former Ministry of Marine, now used as the German headquarters in Paris. They made two circuits, and the first time they attracted little attention, but when they went round again the Parisians tumbled to what was taking place. So did the Germans, and some of their officers were seen dodging about in the search for cover. But the only shots which the British airmen dared to fire were shells from their four cannons into the German headquarters building. It is to be hoped that they at the very least upset some nice, tidy, important files.

Photographs have been taken of Emden since the heavy R.A.F. raid on the place on June 6th, and these show that the damage was very extensive. In fact, it was the heaviest raid which that town has yet had to endure. In particular the damage ought to hamper the production of U-boats, and to interfere with that is one of the most valuable contributions which Bomber Command can now make towards the winning of the war. It has been estimated lately that U-boats have been turned out at a faster rate than the Allied Navies and Air Forces have been able to sink them, and so anything which scotches the wasps in their nests is of the utmost value.

Air activity in the South-West Pacific has been growing more intense than ever of late, and the Japanese have made a succession of air raids on Darwin and Port Moresby. The Australians and Americans have been keeping up their regular air bombardments of Rabaul, Lae and Salamaua. One must suppose that the increased energy of the Japanese is a spiteful desire to avenge their naval defeats. The battles of the Coral Sea and Midway Island have seriously reduced the naval power of Japan, and have at the least postponed the day when they can invade Australia. Air bombardment cannot take the place of an invasion, when the object must be to seize the Australian harbours, and especially Sydney, so as to deny the

ENEMY AIR LOSSES TO JUNE 20th.

	Over G.B.	Over Continent	Middle East
June 14	0	0	6
" 15	2	0	18
" 16	0	1	5
" 17	0	0	4
" 18	1	0	2
" 19	0	4	0
" 20	0	4	0
	3	9	35

Totals: North, 5,998; Middle East, over 4,013.

nse of them to the fleets of the United Nations in the future. Japan's only hope (if it can be called a hope) of securing her conquests must be to occupy all the bases from which the United Nations' fleets can start a counter-offensive, and the Australian ports are now the most important of such bases. In any case, the bombing raids on Darwin have not done much harm.

Fall of Tobruk

THERE is no denying that the Empire forces have met with a nasty reverse in Libya. The evacuation of Bir Hakeim looked ominous, and so did the breach in our minefields made by the Axis. Then the main body of our armour (which is the modern term for tanks) ran into a sort of ambuscade one evening, and suffered heavy losses. That crippled our power, and we forthwith set about withdrawing our main forces to the frontier of Egypt. The divisions at Gazala were extricated by a bold and skilful move, but Tobruk remained a large note of interrogation. Some of the best-informed correspondents on the spot and in Cairo discussed the pros and cons of either preparing the place for another siege or evacuating the garrison.

Rommel did not give us time to make up our minds. He first sent out a reconnoitring force to test our line on the Egyptian frontier, but with clear orders not to engage in a heavy battle. This force accordingly withdraw when we snapped at it. Then he threw the full weight of his forces against Tobruk, and overwhelmed the defences, such as they were, by sheer weight of metal. The garrison surrendered—according to Axis accounts—on the morning of Sunday last, June 21st. The Germans and Italians claim to have taken 25,000 prisoners, including several Generals, and a great quantity of equipment.

The loss of the place is not only a blow to our prestige, but it places all the North African ports west of Egypt in the hands of the Axis, and Tobruk is much the best of these ports in Cyrenaica. The loss of the troops (quite apart from the anxiety which everybody will feel for the fate of individual officers and soldiers) is a most unwelcome diminution of our armed strength at a time when man-power is somewhat of a problem to us. The loss of the material, including, we must suppose, the supplies on the ships recently escorted into the harbour with so much gallantry by the Navy, is also a matter for deep regret.

There seems some doubt as to whether we retained the air superiority which we held when these operations began. Some reports say that German dive-bombers played a major part in rendering Bir Hakeim untenable, and also in the assault on Tobruk. At times our fighters got at the bombers over Bir Hakeim and made them pay for their audacity, but there seem to have been intervals when the Stukas and Ju 88s could work their wicked will. When Tobruk was assailed, the Empire squadrons were engaged in withdrawing to airfields farther back, after having fought up to the very last possible moment. The ground crews must have had an appallingly hard time, and no praise is too high for them.

There can be no doubt that the R.A.F. was not able to fulfil the role marked out for it of preventing supplies from reaching Rommel's fighting front. The destruction of vehicles by our aircraft was enormous, but it is clear that enough got through for Rommel's purpose. From the first it had been recognised that in the desert aircraft bombs were not the right weapon for attacking tanks, and though there have been allusions in recent communiqués to air attacks on German armour, evidently only the lighter enemy tanks proved vulnerable to the fire of our aircraft cannon or to the bombs of the Kittyhawks.

Flt. Lt. A. K. Gatward, the pilot of a Coastal Command Beaufort who skimmed the Paris roof-tops to drop a Tri-colour on the Arc de Triomphe.

Caught in the Bay of Biscay, this U-boat was forced to surface by the bombs of a Sunderland which then attacked with its guns, whose raking fire is seen straddling the submarine.

Lt. Gen. C. Willoughby Norrie, D.S.O., M.C., Commander of the 30th Corps, with his A.D.C., Lt. Grant Singer, inspecting the self-sealing fuel tank of crashed Italian aircraft near Sidi Rezegh

BRITISH AIR LOSSES TO JUNE 20th.

	Over G.B. A'crft.	Over Continent B'brs.	Over Continent F'trs.	Middle East A'crft.
June 14	0	0	0	4
" 15	0	0	0	17
" 16	0	8	1	8
" 17	0	0	1	4
" 18	0	0	0	0
" 19	0	9	3	6
" 20	0	7	6	0
	0	24	11	39
	—	—	—	(14 pilots safe)

Totals: North, 3,989; Middle East, about 1,289.

HERE AND THERE

Canadian Appointment

THE appointment recently announced of Mr. Anson C. McKim as Deputy U.K. Representative of the Canadian Department of Munitions and Supply coincides with the completion of two years of vitally important work by the office of the U.K. Representative, Mr. C. A. Banks.

In that time the London staff has expanded under his energetic direction from one assistant and a secretary occupying two rooms in Canada House to a staff of 100, with offices in St. James's Square.

Like Mr. Banks, Mr. McKim brings to his work a sound knowledge of the United States and Canadian industrial scenes.

Eire Model Aircraft Contest

EIRE National Agricultural and Industrial Development Association, in conjunction with the Model Aeronautics Council for Eire, is to hold a national model aircraft competition at an airport in County Dublin on Sunday, August 16th.

The contests will consist of competitions for Wakefield class model aircraft of Irish design, an inter-club team event and a petrol model event.

First prize in the Wakefield class event will be a perpetual challenge trophy and silver medal. A special silver medal will be awarded for design and/or workmanship.

U.S. Aircraft Output

SENATOR ELMER THOMAS, chairman of U.S. Appropriations Committee, has stated in Washington that since the Japanese attack on Pearl Harbour on December 7th, 1941, the production of complete aircraft in America has gone up by 85 per cent., and the output of aircraft engines by 80 per cent.

America, he said, was now producing close on 5,000 aircraft a month, which suggests that the estimate recently given by J. Carlton Ward, Jnr., president of the Fairchild Corporation, who mentioned a figure of 3,300 a month (as recorded in *Flight* of June 11th) erred on the side of modesty—unless, of course, it is the good Senator who is being a trifle too optimistic; one imagines, however, that his figures are official.

A tricycle-undercarriaged penguin, known as the Hoppity, which has been built by two flight officers of No. 1440 Sqn. A.T.C. It is used for taxying practice. The engine is a flat-twin Douglas taken out of a motor cycle.

A.T.C. 200,000 Strong

LESS than eighteen months after its inception, the A.T.C. has now reached a strength of 200,000 cadets.

How steady and persistent has been the growth of the movement can be seen from the figures for membership that have been given in public from time to time. Within a month of the official inauguration of the scheme in January, 1941, there were at least 50,000 members, and recruiting was proceeding rapidly. By September the membership was roughly 160,000, and by January, 1942, it had risen to 180,000.

The present membership is probably better in quality than previously, for cadets are now put on probation for three months and are not included in the strength of the unit until they have shown that they take their work seriously.

Incidentally, A.T.C. Cadets in camp at a bomber station helped in bombing up for the Cologne raid.

The bomb bay on the Avro Manchester is non-compartmented and bomb dimensions are limited only by the width of the fuselage.

Act. Wing Cdr. D. C. T. Bennett (No. 10 Squadron) who has been awarded the D.S.O. The official citation appears on page 653. Wing Cdr. Bennett will be remembered for his record flights in *Mercury*, the upper component of the Short-Mayo composite aircraft.

In the Bag

PROTECTING aircraft engines from the harmful effects of moisture is quite a problem when they have to be stored or shipped abroad.

Pratt and Whitney have developed a new method of packing to cope with this potential enemy; they enclose the engine in a pliofilm envelope (we should call it cellophane) before it is crated.

Inside the envelope are placed a number of small dehydrating bags which absorb any moisture surrounding the engine. Special plugs containing dehydrating crystals are also inserted in the sparking-plug holes, a humidity indicator card included, and the pliofilm bag is then closed and vulcanised.

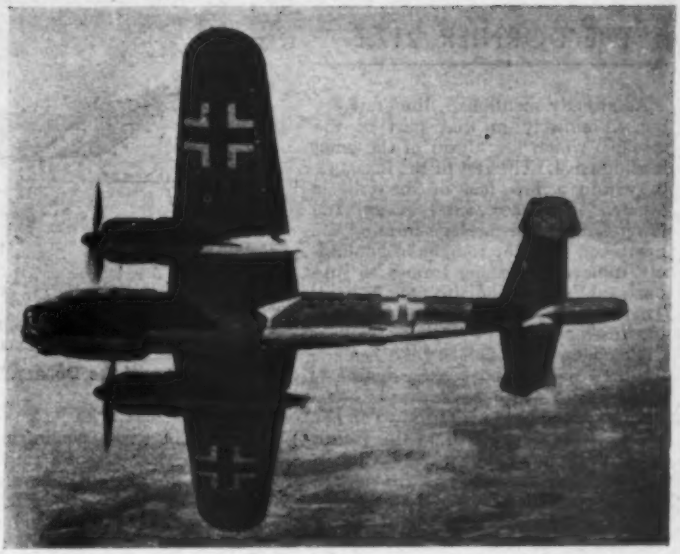
This method not only lengthens the period of safe storage but does away with the need for greasing the outside metal parts before shipment.

The DORNIER 217.E

Unusual Dive-brake Arrangement : Automatic Pull-out : Slotted Fins : Fan-cooled B.M.W. 801 Engines Housed in Close-fitting Cowls

DEVELOPED from the Dornier Do. 17 and Do. 215, the Dornier Do. 217.E differs from both not only in the engines installed but in several structural and aerodynamic respects. By the courtesy of the Ministry of Aircraft Production our representatives have been permitted to examine and illustrate one of these machines, captured in a somewhat damaged condition but still affording a basis upon which to form an opinion of this latest Dornier product.

Two features of the Do. 217.E are of particular interest: the installation of the two B.M.W. 801 engines, and the novel form of air brake employed to limit the speed in a dive. The machine can, of course, be used both as an ordinary bomber and as a dive bomber. The specimen examined was not actually fitted with the new air brake, although arranged for its use, and so presumably had been used as an ordinary bomber.

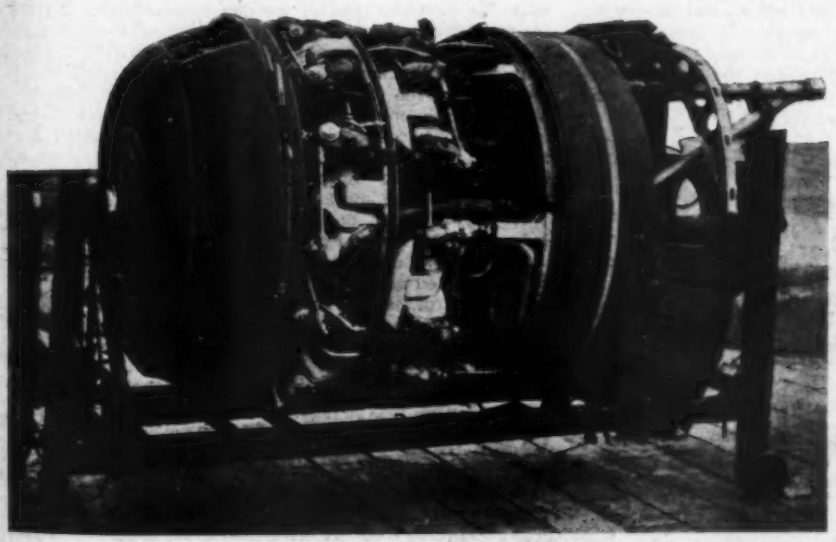


A Dornier Do.217 on a practice flight. This machine is fitted with an air brake in the stern of the fuselage in place of the more orthodox type in the lower wing surface.

Family Likeness

For the rest, the 217.E has a strong family resemblance to the earlier Dornier types, with which it shares the extensive use of electrical services. The machine is a high-wing monoplane powered by two B.M.W. 801 engines. A crew of four is carried, comprising pilot, bomb-aimer, top rear-gunner-radio operator, and bottom rear-gunner. The cabin occupies the same position as on the Do. 17 and Do. 215, and its layout is similar. The crew's compartment is entirely forward of the leading-edge of the wing. Compared with the Do. 17.Z the wing span has been increased by about four feet to 62ft. 5in. The machine is of all-metal construction, including the control surfaces. The surface finish might be described as "average" except near the nose, where it is rather poor.

The main aerodynamic design does not present any unusual features, the layout being that usual in twin-engined aircraft, but there are certain unusual arrangements, chiefly in connection with the controls. For example, the directional stability does not appear to have been all that might be desired, and the fixed tail fins have fixed slots in their leading-edges, presumably to prevent them stalling when the aircraft is crabbing, such as would be the case when flying on one engine. The air brakes normally found on the under-surface of dive bombers are not fitted in the Do. 217.E. Their place has been taken by an arrangement in the stern of the fuselage which works somewhat after the fashion of a parachute. In the specimen examined the tail piece for a normal bomber was fitted instead, and a more detailed description of the way it is fitted, and of the manner in which it can be jettisoned, will be given later in these notes.



Close cowling and fan cooling are features of the installation of the B.M.W. 801 engines in the Do. 217.E. Note the type of flame-damping exhaust pipes behind the cowling.

In its structural details the Do. 217 E differs a good deal from earlier Dornier types. The fuselage is built in three sections, of which the middle portion is integral with the wing centre-section. Continuous stringers of rolled Z-section pass through notches in the fuselage frames, most of which are also of Z-section. At the top and bottom, and lower sides of the fuselage the Z-section stringers are replaced by members of extruded T-section. Each part of the fuselage is joined to the next by 25 bolts passing through flanges riveted to the skin. The skin plating is flush-riveted.

THE DORNIER 217.E

As already mentioned, the crew are housed entirely in that part of the fuselage which lies ahead of the wing leading-edge. The rest of the fuselage, to within a few feet of the tail, is divided in a horizontal plane, the lower half of the fuselage forming the bomb cell, and the remainder containing transverse bracing frames to support the weight of the bomb load. There are three pairs of bomb doors in the fuselage.

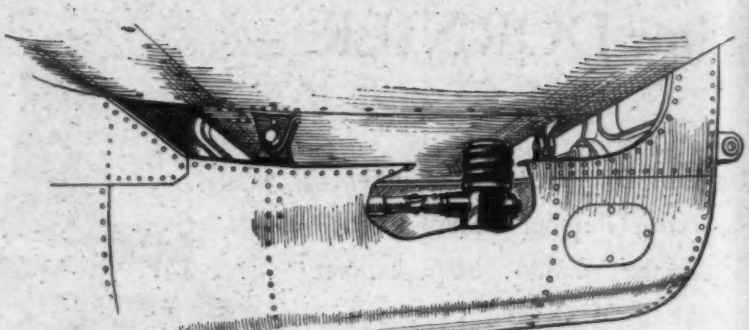
The wing of the Do. 217.E-1 is made in three parts. The centre-section is 29ft. 5in. in width and incorporates a portion of the fuselage. The two engine nacelles are also carried on this part of the wing. The two outer portions of the wing are each 16ft. 6in. in length.

Two spars are used in each part of the wing. Throughout the span of the wing both spars have T-section flanges. In the centre section the front spar has a double web, the rear one being a solid plate web, and the front one a lattice web, the bracing members being of T-section. The whole of the rear spar and the outer sections of the front spar have lattice webs with T-section bracing members. A small number of solid plate ribs are used in the wing. The attachment of the outer portion of each wing to the centre section is by four large bolts at each spar, and, in addition, about twenty smaller bolts through corresponding flanges on the inner and outer wings round the periphery of the wing section between the spars.

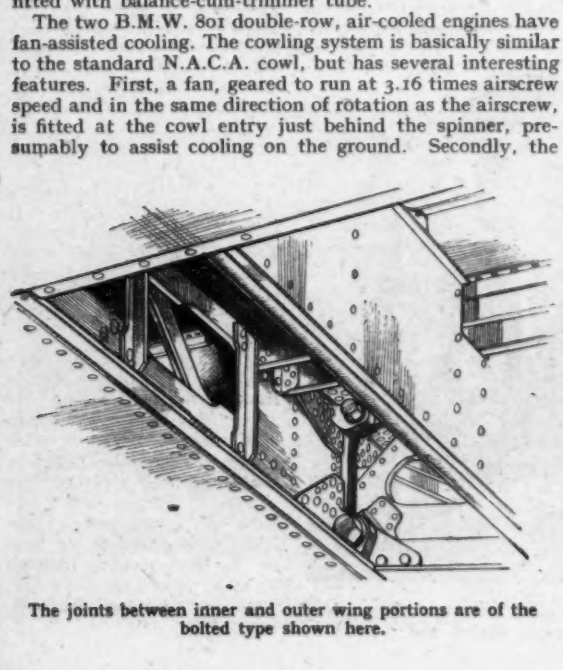
Electrical Tail Trimmer

The tailplane fits into a recess on the top of the fuselage, as in the Do. 17-Z, and the elevators have a similar mass-balancing arrangement. The tailplane incidence is adjustable; the range, according to a small plate fixed on the fuselage side, is 10 deg. down and 2 deg. up. (The operation is electrical and simultaneous with the flaps.) The tailplane can, however, be adjusted separately by a large-diameter wheel which is also the emergency operating gear for the undercarriage and the flaps. The elevators are fitted with balance-cum-trimmer tube.

The two B.M.W. 801 double-row, air-cooled engines have fan-assisted cooling. The cowling system is basically similar to the standard N.A.C.A. cowl, but has several interesting features. First, a fan, geared to run at 3.16 times airscrew speed and in the same direction of rotation as the airscrew, is fitted at the cowl entry just behind the spinner, presumably to assist cooling on the ground. Secondly, the cooling exit area is controlled by the fore-and-aft movement of a ring forming the trailing edge of the engine cowling. Under climbing conditions the spoiling drag, due to normal type gills, will be avoided. Presumably the suction at the exit induced by normal gills when open, and necessary to provide sufficient flow to cool an engine on the ground and during the climb, can be dispensed with when a fan is fitted. A feature of the cooling system is the complicated system of baffles necessary to ensure adequate cooling of the cylinder heads.



The tailplane of the Do. 217.E is trimmed for extra control beyond that given by the elevators.



The joints between inner and outer wing portions are of the bolted type shown here.

A reversed-flow oil cooler is mounted in an annular ring inside the nose of the cowl. Cooling air from the front of the engine is by-passed forward through the oil cooler, and passes out through a nose slot exit, which can be set in two positions (fully open and closed).

The engine intake air and warm air for cabin heating and wing de-icing are also drawn from inside the cowl, which, therefore, has a very clean external appearance, the only departure from the circular cowl being the two ducts, one on each side, which lead the engine air over the cylinder heads to the supercharger intake. The arrangement of the exhaust pipes is interesting. One of these pipes is fitted per cylinder, and all pass out of the cowl at the cooling air exit in three groups of six, four and four. This design of exhausts provides flame damping without losing the advantage of the exhaust thrust.

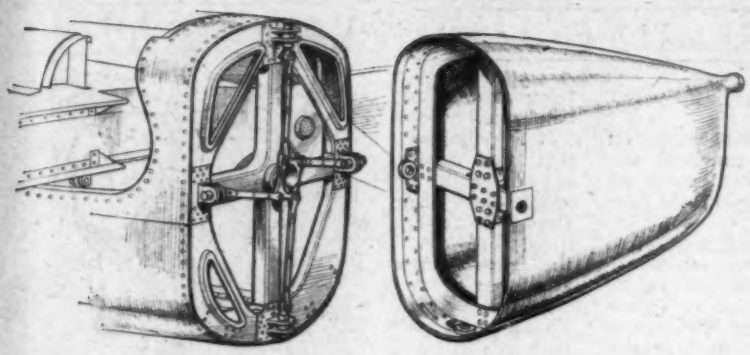
Wooden Airscrew Blades

Airscrews are of the three-bladed, fully feathering type, with the Schwarz type of wooden construction. All the blades had been broken off, but it was possible to estimate the diameter as between 12ft. 9in. and 13ft. It appears that the pitch change is effected by a hydraulic pump mounted on the engine nose, the pump being controlled by an electric motor, while an adjacent hydraulic speed governor, interconnected with the throttle control, constitutes an automatic control switched into operation by a two-way switch. Both airscrews are right-hand tractors.

Reverting once more to the engines, these have two valves per cylinder, one inlet and one exhaust, both ports being on the rear side of the cylinders.

The pump has been redesigned, and is of cylindrical form mounted on the rear of the engine, with a bakelised fabric control capsule case and servo unit. A mixture control is not fitted. New type injectors are fitted in the cylinders at the rear between the valves. A small oil tank at the rear of the engine supplies a separate oil pressure pump to supply the injection pump and boost control oil servo controls, etc.

The supercharger and induction system are fitted between the crankcase and the rear auxiliaries gear box; there are two flat side intakes with entrance grids, and these open by cowling ducts round the cylinders to the front of the engine, receiving air from inside the cowling. The two intake throttles are geared to an oil servo-operated variable datum boost control. There is no control connected which indicates a second supercharger speed. No



The stern portion of the fuselage can be jettisoned by this arrangement of bolts. The stern portion shown is that used in the ordinary bomber. When the Do.217.E is used as a dive-bomber, this is replaced by the air brake unit.

leak pipe from the fuel injector leads to the inlet valve as previously.

A Bosch single-drive unit magneto (ZM14 CR10 type) is mounted on the nose top, serving two front plugs per cylinder, one plug inboard each valve.

Each cylinder exhausts separately through a pipe terminating in a fitting having five slotted passages for flame damping 3in. × ¾in. wide, projecting about four inches outside the cowling at the cooling air jet. The pipes are grouped with six on top and four each side.

The cylinders are closely baffled on head and barrel, and the whole unit with oil cooler is covered by a long-chord cowling 4ft. 6in. overall diameter supported by brackets connected to several cylinder rocker boxes with rubber bushed pins. A twelve-bladed fan geared up about 2½ times airscrew speed rotates in the same direction as and just to the rear of the airscrew in the cowling front opening, which is 2ft. 8in. diameter. The blades are of aerofoil section, 5¼in. high and 4in. full width.

Oil Cooling Arrangements

The oil cooler is fitted in the curve of the cowling nose piece, and consists of round tubes with disc fins. The leading edge ring of the cowling is moved fore and aft by several cranks from an electric motor, the ring varying the width of an annular slot controlling the air flow through the cooler, which is built up of 12 rows, each of five tubes, in a close assembly. A cowling sleeve ring at the rear of the cylinders is similarly moved to vary the cooling exit area. An electrically or hand-energised inertia starter is mounted on each engine rear cover; no fuel priming system was noted.

An oil tank is fitted outboard of each engine nacelle in the wing. The dipstick gave 250 litres capacity, but the wing cover plate was marked to indicate that for 87 octane fuel only 200 litres were to be filled in.

There are five wing fuel tanks, made up of one middle tank, two inboard of the engine nacelles, and two outboard of the oil tanks. It will be noted from the oil-tank marking that the normal German fuel is specified.

One fixed M.G.151 (15 mm.) gun was mounted in the lower port side of the nose, firing forward and operated by the pilot, using a Revi 120 gunsight. Approximately 250 rounds of ammunition were carried in a box on the port side of the nose, with a rigid ammunition chute. The mounting was similar to that for the M.G.151 in the Ju. 88 night fighter.

Only three M.G.15 (7.92 mm.) guns were fitted, two firing laterally through the rear upper side windows and operated by the W/T operator, and one in the ventral position. All three guns were on gymbal mountings. Twenty-eight spectacle drums of ammunition (75 rounds each) were carried. The cockpit cover was missing, and this presumably had either one or two M.G.15 guns, firing aft, and also operated by the W/T operator.

Two further gun positions, with gymbal mountings to take M.G.15 guns, were situated one on each side of the cockpit, about midway along the upper side windows, but no guns were fitted. A mounting for a free 20 mm. cannon was fitted in the lower starboard side of the nose for use by the bomb aimer. No gun was fitted, and the gun port was blanked off by a sheet of metal.

The 15 mm. ammunition was of two types only, one with a yellow body and brass-nose fuse, probably H.E./Tracer, and the other with a black body of the sharply pointed A.P. type. They were in cycles of two yellow and one black.

The bomb installation was completely different from that on the Do. 17.Z, and the carriers were entirely new. On the Do. 17.Z the bomb cell occupied the whole depth of the centre section of the fuselage, having stowage for either 20 × 50 kg. bombs stowed in tiers of five, or 2 × 250 kg. bombs along the centre line of the aircraft.

On the Do. 217 the top half of the centre section of the fuselage was fitted with a petrol tank and inflatable dinghy stowage, and only the lower half was used as a bomb cell, fitted with four 500 kg. carriers, two on each side.

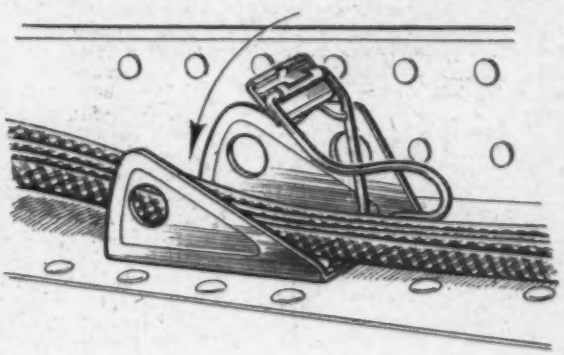
Bomb Beam Details

A pair of channel girders, placed back to back and about 3in. apart, comprised the bomb beam in which the E.M. release and fusing unit was held and to the outside of which crutch arms were fixed, the crutch feet being adjustable in pairs by means of a lever on the side of the beam. One continuous section of this beam was fixed permanently to the aircraft structure along each side of the top of the bomb cell, each section being fitted to take two bombs.

The release unit and two fusing units for each carrier were held between two stout steel plates, 60 cm. × 13 cm., comprising one complete unit, which was intended to be fitted to the bomb and hoisted up with it to the beam. The unit was held in the beam by two 2.25 cm. diameter bolts, which were engaged or withdrawn by means of a rack and wheel arrangement, operated by a lever on the side of the beam.

The release mechanism worked on the toggle-lock principle, and was operated electro-magnetically by means of a standard Siemens rotary magnet. It also incorporated mechanical release mechanism, a loading latch, a cocking button and a small window to check visually that the unit was cocked.

The pilot's seat had a curved shield 8.5 mm. thick, 120 cm. high and 52 cm. broad fitting round the back of the seat. The bucket of the seat also had armour plate, about 5 mm. thick, and 5 mm. plate was fitted on top



Wire clips working somewhat on the principle of the mouse-trap are used to secure electric leads.

THE DORNIER 217-E

of the cockpit, above and slightly to the rear of the pilot's head.

A bulkhead, 8.5 mm. thick, roughly semi-circular in shape and measuring 120 cm. wide by 50 cm. deep, was found in the wreckage, which may have been located aft of the ventral gunner, who is otherwise unprotected from the rear.

Two curved triangular plates, 5 mm. thick, were fitted one on each side of the rear upper cockpit, probably an extension of the armour which would almost certainly be fitted to the rear of the cockpit cover. A large curved plate was also fitted on top of the fuselage immediately aft of the cockpit. The stowage recess for the inflatable dinghy was armoured with 8.5 mm. plate at the rear and 5 mm. plate along the sides, bottom and top.

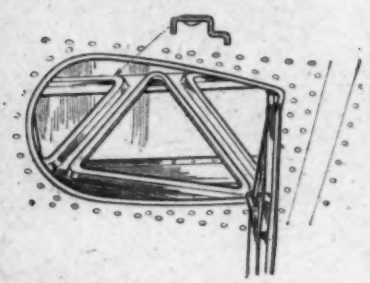
De-icing Equipment

De-icing equipment is fitted to the wings and airscrews, a hot-air system being employed in the wings and a fluid and slinger ring system on the airscrews. Hot-air sprays are fitted to the pilot's windscreen and to each of the windows in the nose of the aircraft. No provision for de-icing is made on the tailplane, fins or aerial mast.

The heater muffs are fitted to the exhaust pipes from the front and rear top cylinders, and take the form of tubes concentric with the exhaust pipes with one end open and the other end ducted into the wing-heating system. Small metal tongues are riveted to the inside and outside of the exhaust pipes to assist heat radiation.

The whole of the dive-bombing equipment is operated electrically, by motors or solenoids, and the system seems to have been made as fool-proof as possible. When the pilot has switched on his bomb release and fusing circuits, so opening the bomb doors, he merely has to press one switch to start his dive and extend the diving brakes, and another switch to pull out of the dive. When the bombs have been released, the bomb doors close and the brakes retract automatically. There is also provision for controlling the airscrew pitch during dive-bombing attacks.

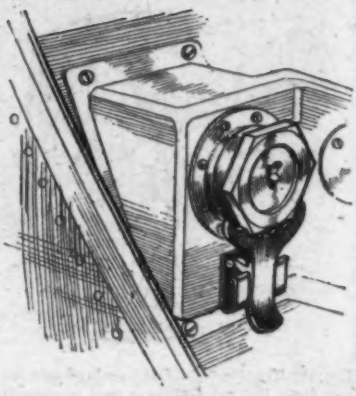
Reference has been made to the diving brakes fitted in the stern of the fuselage. The exact nature of the brake itself is not known, but from German sources it is gathered that it works like a parachute. In the aircraft examined there was a torsion rod extending from the cockpit to the rear end of the fuselage with a free splined end (for jettison) which probably fits on to a screw jack operating the dive brakes.



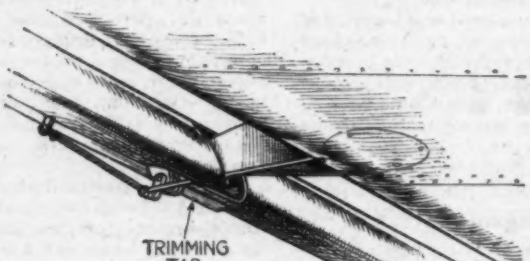
A lattice wing rib as seen through an inspection door in the underside of the wing.

Whichever tail-piece is fitted, it can be jettisoned by an arrangement of four long bolts, cam-operated by the torsion shaft mentioned above. The whole design is very much like that employed by the Dornier company in their flying boats for locking the water-tight doors in bulkheads.

It is estimated that the maximum loaded weight of the Dornier Do.217-E is 33,500 lb. As the gross wing area is 610 sq. ft., this gives a wing loading of no less than 59.4 lb./sq. ft. It is estimated that at the full loaded weight, and with a take-off power of 3,160 b.h.p., the take-off distance is 1,550 yards, and it is concluded that when the machine is operating with maximum load assisted take-off is employed. This supposition is strengthened by the fact that a nose hook and a tail support are fitted. The estimated initial rate of climb is 638 ft./min., the maximum speed 309 m.p.h., and the cruising ceiling 19,100ft.



This type of locking clip for securing nuts is used extensively on the Do. 217. E, particularly in the engine installation.



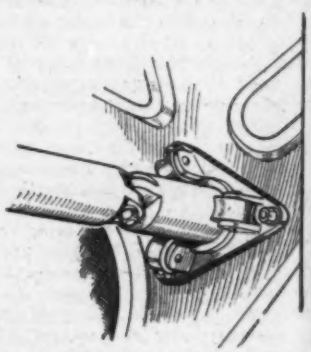
The ailerons are of the slotted type, carried on set-back hinges. They are provided with tabs which act partly as balances and partly for trimming.

Four 500-kg. bomb-carriers are fitted in the bomb cell, with provision for replacement by 1,000-kg. carriers. A bomb-carrier, probably of the 250-kg. type, can be fitted under each wing, and there are fittings to take external fuel tanks on these carriers. Strong points are provided for carrying either one torpedo or one type C mine, or two type D mines. From consideration of stowage space it is concluded that the maximum bomb load is about 3,000 kg. (6,600 lb.).

The Dornier Do.217.E has a wing span of 62ft. 5in. The wing chord at the root is 12ft. 9in. and at the tip 6ft. 9in. The aspect ratio is low at 6.62. At the root the ratio of thickness to chord is 17 per cent., and at the tip 8 per cent.

Relative to the Do. 17.Z, the wing span has been increased by about 4ft. and there is no dihedral on the top surface. The span of the tailplane has also been increased from that of the 17.Z in order to bring the twin fins and rudders into the same position relative to the engines.

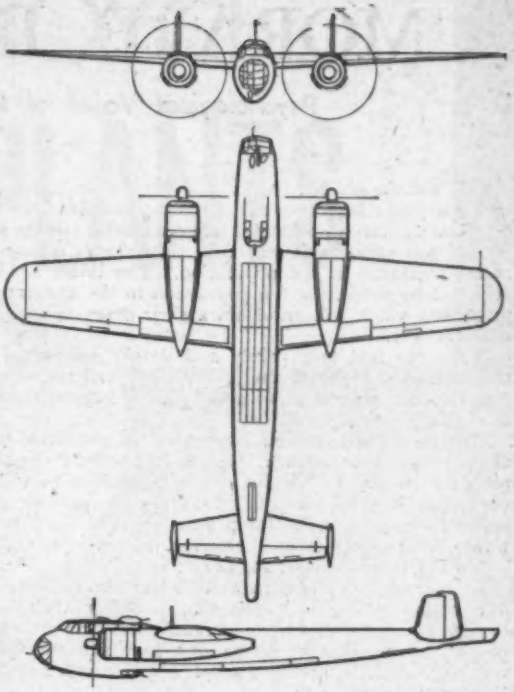
The flaps are of the split type but have a shaped nose-gap, the fixed hinged points being fairly low. They do not extend to the trailing-edge of the wings and are divided by the engine nacelles. The angle for landing appears to be about 60 to 70 degrees.



This type of fair lead with rubber rollers is used for control push-pull rods.

THE DORNIER DO. 217.E

Beauty is not a prominent feature of the Do. 217.E. All four members of the crew are housed in the cabin ahead of the wing.



Three-view general arrangement drawings of the Do. 217.E.

In conclusion a brief mention may be made of the controls of the Do. 217.E. The ailerons are of the slotted type and are fitted with tabs. The flaps are of the split type, but in the "down" position a shaped slot is left between the top surface of the flap and the fixed portion of the wing. The correct shaping of the slot thus formed is ensured by setting the flap hinges relatively low. The flaps are electrically operated via a motor and a screw jack. The flap operating loads are reduced by a spring.

Each elevator has two tabs, one for balance and trimming, and the other for automatic recovery from dives with diving brakes. This latter is electrically operated, and the arrangement is considerably simpler than the hydraulic system used on the Ju. 88, which was described in *Flight* of December 5th, 1940. On the Do. 217.E, a solenoid plunger operates the control rod, a spring being incorporated in the unit for returning the control rod. The solenoid windings are connected to the diving brake circuit, and as the diving brakes are extended on entry into a dive, the solenoid plunger forces the elevator tab upwards, thus causing the main elevator to move down and starting the dive. When recovering from the dive by use of the automatic control, operation of a switch in the cockpit breaks the solenoid circuit, thus allowing the control rod spring to depress the tab, raise the elevator and starting the pull-out.

The end of a Dornier 217. This machine was brought down in England some months ago, and, as will be seen, was not too badly damaged. This tail did not have the dive brake which is fitted on some examples.

MORALE IN AIR RAIDS

Psychological Value of the Blitz Reduced to a Formula

By DR. V. L. GRUBERG.

AIR attacks on the enemy's country serve a two-fold purpose: first, they are to destroy and interfere with his military installations and production centres vital for his war effort, and secondly, they are to reduce the moral resistance of the population. The latter is to be achieved by subjecting the population to the dangers and privations which will grind down their desire to carry on with the war.

While the first task purely and simply means the destruction of as many of the enemy's material resources as possible, the second is of a far more complex nature, deserving a special study.

What is the object of air attacks on the populated cities of the enemy's hinterland? Clearly it is not the *numerical* reduction of the population, let alone its total annihilation, that is being sought for. The only purpose is to enforce a general desire for peace, to produce a *reaction* which would sweep away the people from the path of war and make them clamour for peace.

To release such emotions and to have them translated into action is therefore the purpose of air attacks. It implies the piercing of the psychological armour of the people, by stimulating a condition in which the will to resistance and to further combat is gone, and a state of "demoralisation" sets in.

Lessons of Experience

Whether air attacks can actually achieve this is still the matter of speculation. Previous experiences and such as have been gathered during this war do not as yet effectively substantiate the supposition that air attacks can critically alter the morale of the people.

General Emile Herrera, a well-known Spanish aeronautical authority and member of the Spanish Academy of Science, describing the effects of "total" air attacks on the cities during the Spanish war, says: "The partisans of this kind of attack believe that the civilian population, terrified by the violent explosions of bombs and by the sight of horrors so created, will dash out madly into the streets to implore the public authorities for the conclusion of peace no matter at what price."

The massacre of a few innocent and the destruction of some buildings would thus justify the invitation of a major evil by terminating the war. Meanwhile—writes the General—the results of the experiments conducted by foreign aviations engaged in the "total bombing" in Spain have failed their protagonists because the psychological *reaction of the civilian population under such conditions is by far more complicated than first appeared.*

This reaction of a multitude towards air raids is determined by a number of psychological and material factors. Although it is hardly possible to dissect into detailed fragments the subtle inter-play of such psychological factors and their variations, the following appear to be of main importance:—

	Symbols
Intensity of raids	(*Ir*)
Frequency of raids	(*fr*)
Fear	(*F*)
Hatred of the enemy	(*H*)
Material attachment	(*M*)
A.R.P. Facilities and A.A. Defence	(*Ar*)
Intensity and kind of influence of the domestic propaganda	(*Ip*)

The significance of each one of these components should not be underestimated. The elimination of any one of them would materially alter the reaction of the people under air-raid conditions. Thus the protagonists of a total bombardment of the civilian population believed that the fear of the civilian population grows in a direct proportion to the intensity of air attacks. This profound error of judgment can be now totally disproved in the light of experiences of the present war. For in the first place the fear of a multitude is different from the sensation of fear of the individual. In the latter case the intensity of physical fear is logarithmically proportional to the sensation; in the case of a collective psychological fear of a group, however, a number of other factors come into play.

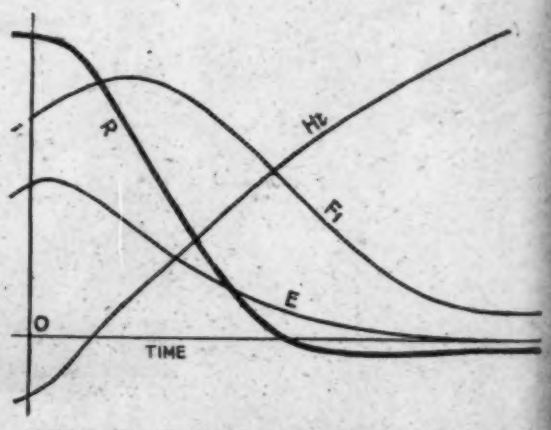
This is best illustrated by the results of the writer's examination of the reactions of one hundred people with "international blitz" experience. All persons studied were above the age of twenty, 60 per cent. men and 40 per cent. women. To the question, "How did the continuation of the raids affect you?" 70 per cent. of those asked replied, "Less fear and gradual matter-of-fact attitude." In fact, the corresponding percentage describing their reaction stated that their apprehensions and fears were of a high order before the commencement of air-raids, with an increase after the very first experience but with a subsequent gradual reduction as they got accustomed to it.

The factor next in scale of importance is the intensity of hatred against the enemy. While it is outside our framework to go into the complexity of "hate against the enemy," it is only relevant to ascertain whether this factor increases collectively under air-raids or not. It is evident that this factor cannot be laid down in a manner common to all communities and nations, and rather depends on the inherent national characteristics.

General Herrera, whom we quoted before, says that "the hatred of the enemy grows almost proportionally with the intensity of the attack, at the sight of wasteful destruction and innocent sacrifices. Particularly in a civil war such as there was in Spain, where in each town there were large elements sympathetic to the other side. The effect of air attacks was *absolutely contrary* to the effects one expected to achieve, since after a bombardment the partisans of the enemy have disappeared, some having been killed, yet others having lost all their sympathies."

But one cannot attribute the same intensity of psychological factors such as hatred indiscriminately to all communities. While the above-mentioned factors are fundamental and can be generally applied to any group, a certain differentiation in their application is necessary.

(To be continued.)



EFFECT OF AIR RAIDS: The graph shows the variation in the intensity of important psychological factors. With the increase of time the curve for fear is gradually descending, while that for hatred (H) rises.

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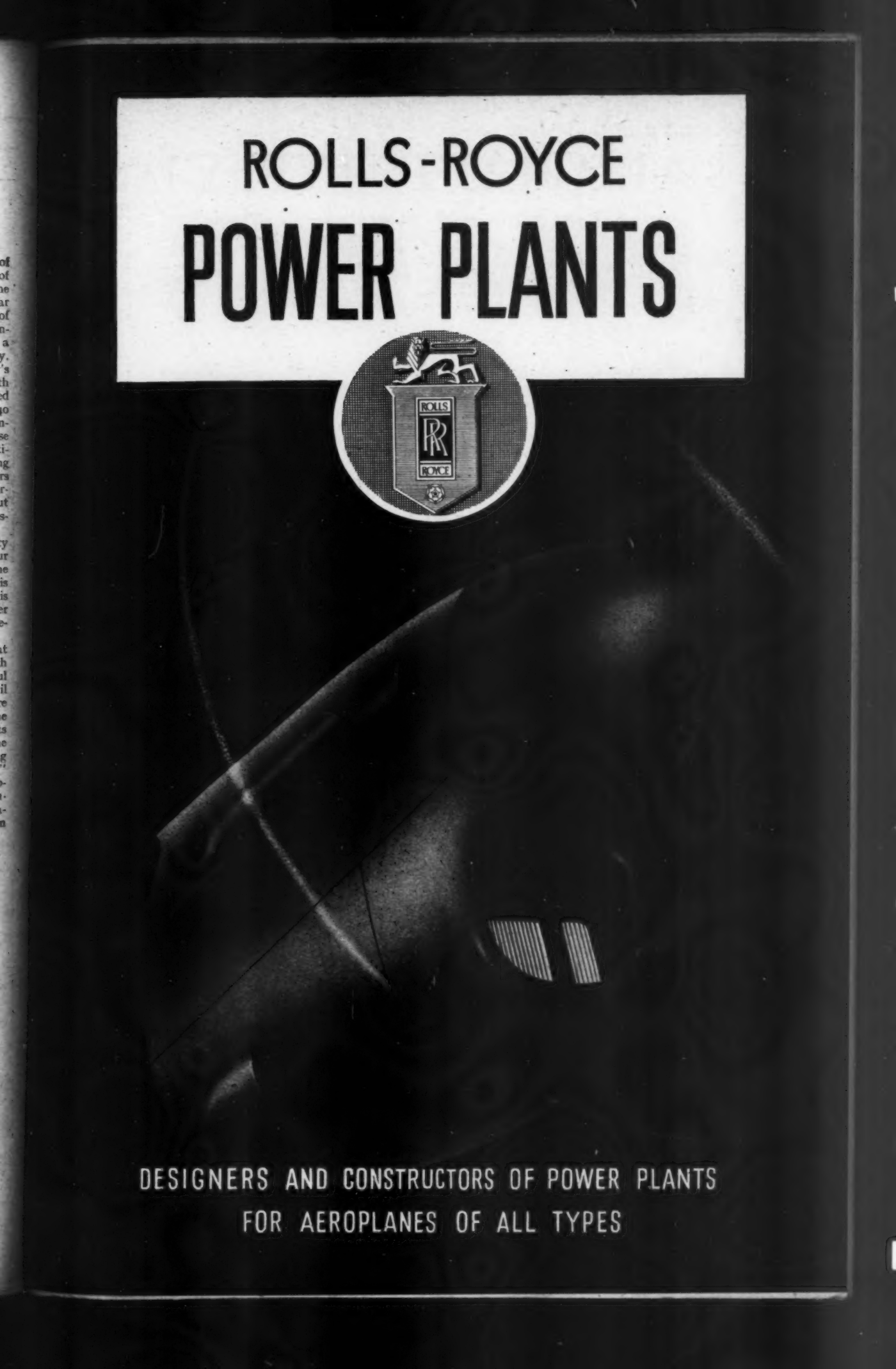

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AIRCRAFT TYPES AND TE

Airacobra and Martlet Fighters

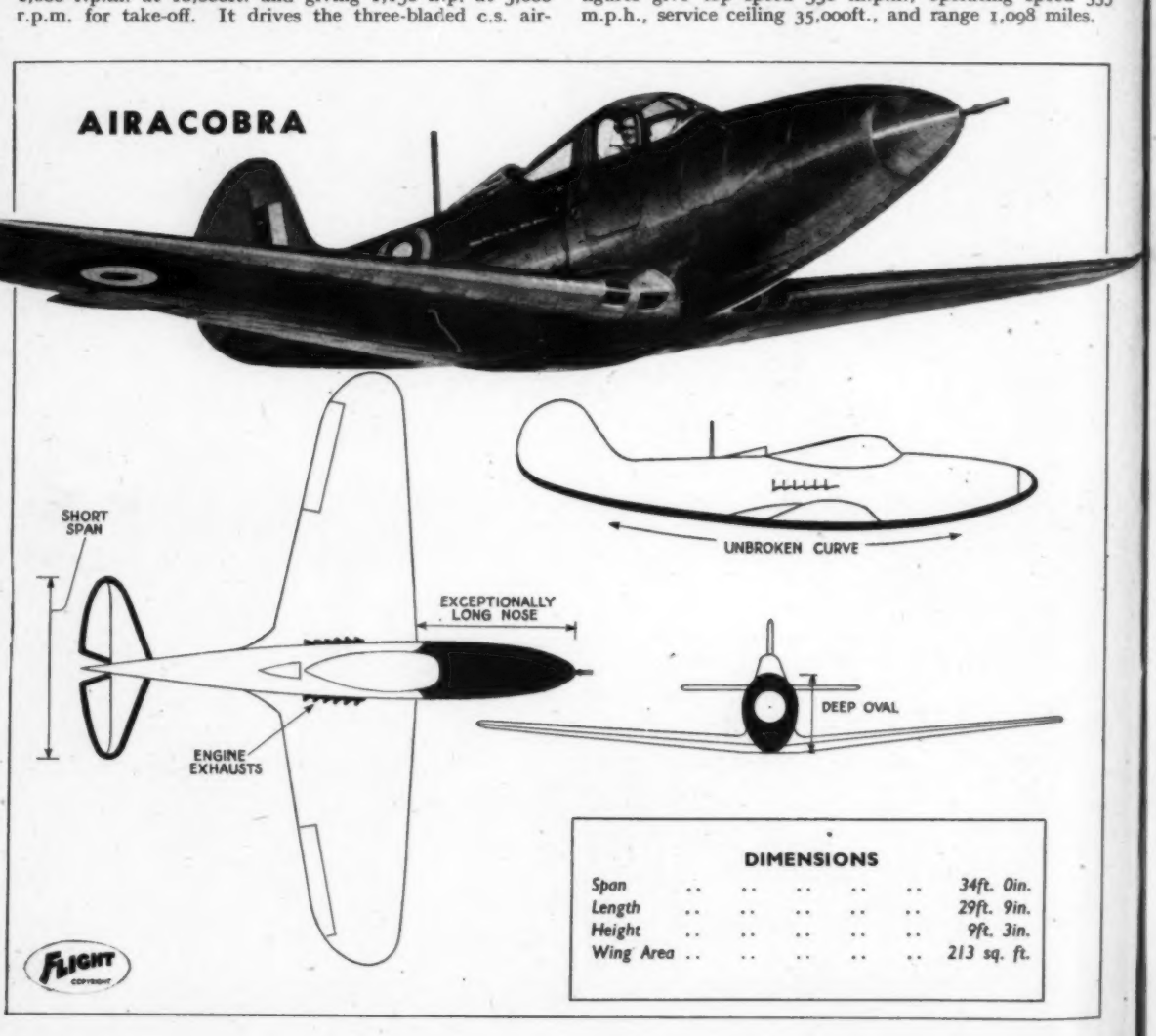
TO the Bell Airacobra goes the palm for being the most unorthodox type of single-seater fighter in mass production to-day, though its external appearance is conventional enough.

First ordered by the British Air Commission in the summer of 1940, it was some 12 months before the production model began to arrive in this country, after which it was not long before the first R.A.F. squadron to be equipped with these graceful aircraft received a full complement of them; this was No. 601 (F) Squadron. According to American reports, large numbers of the Airacobra I have been built specially for the requirements of newly formed anti-tank squadrons of our Army Co-operation Command, and for this purpose mount the heaviest calibre cannon of any single-seater fighter in quantity production. They are also provided with very heavy defensive armour to protect the pilot against the sort of ground fire to be expected when operating at low altitudes.

The most striking departure from the orthodox in design is the placing of the Allison V-1710-E4 engine amidships in the fuselage. This engine is a 12-cylinder in-line liquid-cooled unit with a cruising rating of 1,000 h.p. at 2,600 r.p.m. at 10,800ft. and giving 1,150 h.p. at 3,000 r.p.m. for take-off. It drives the three-bladed c.s. airscrew via an 8ft. extension shaft, which passes beneath the pilot's seat, to a reduction gear mounted in the nose.

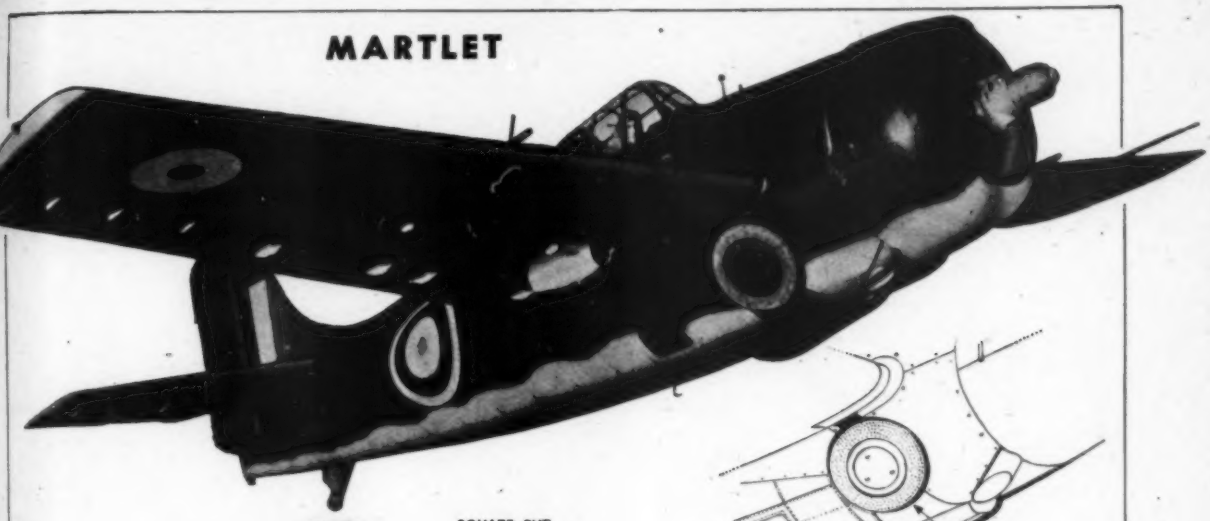
The all-metal fuselage also follows unconventional lines, its main component being a cradle-like structure which provides a rigid mounting for the engine, reduction gear and intermediate shaft. The aft section, carrying the tail assembly, is bolted to the rear bulkhead of the "cradle" immediately behind the engine, and an upper component, which is virtually the enclosed cockpit and whose main member is an inverted U, bolts down on to the side-members of the "cradle." This forms a saloon top for the pilot and is fitted with a car-type door. Light alloy, stressed-skin, flush-riveted covering is employed for fuselage, wings and tail (the two latter being also all-metal structures), but fabric covering is used for all control surfaces except the split trailing-edge flaps, which are metal-covered. The Airacobra is also (so far) the only single-seater fighter to have a tricycle undercarriage.

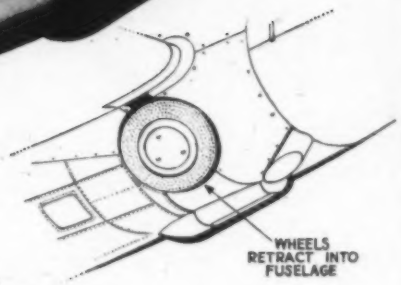
Its armament, as in service with the R.A.F., comprises one 20 mm. cannon firing through the spinner, two synchronised machine-guns in the fuselage and four in the wings outside the airscrew disc. American performance figures give top speed 358 m.p.h., operating speed 335 m.p.h., service ceiling 35,000ft., and range 1,098 miles.

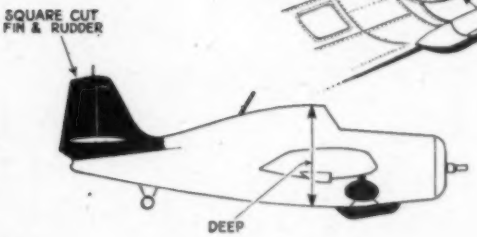

AIRACOBRA
SHORT SPAN
EXCEPTIONALLY LONG NOSE
ENGINE EXHAUSTS
UNBROKEN CURVE
DEEP OVAL
DIMENSIONS
Span .. .. 34ft. 0in.
Length .. .. 29ft. 9in.
Height .. .. 9ft. 3in.
Wing Area .. .. 213 sq. ft.
FLIGHT COPYRIGHT

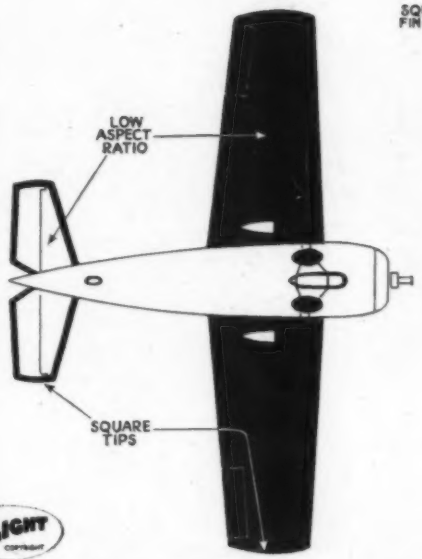
EIR CHARACTERISTICS

MARTLET









DIMENSIONS

Span	*38ft. 0in.*
Length	*28ft. 10in.*
Height	*9ft. 2in.*
Wing Area	*260 sq. ft.*

SHORT and tubby, with square-cut mid-wings and its undercarriage retracting into its belly, the Grumman Martlet I is distinctive in looks if not exactly graceful. It equips a number of carrier-borne fighter squadrons of the Fleet Air Arm which previously used Gloster Sea-Gladiators.

At the outbreak of war the only monoplane fighters in service with aircraft-carriers were Blackburn Roc two-seaters and a few Fairey Fulmars and, although these types undoubtedly had their uses, it was at once realised that the extra speed to be expected from single-seater fighters would be highly desirable. Unfortunately, no suitable British type was available, so an order was placed in America, and the Grumman F4F-3, then being delivered to the U.S. Navy, was chosen.

Certain modifications were necessary to suit British requirements, and the version as exported to Britain received the name of Martlet. Chief among these modifications was the removal of the two .50in. machine-guns from the fuselage and the fitting of four .303in. machine-guns in the wings. Light bomb-racks were also fitted under the wings. British-type deck-arrester gear, radio, armour plate and bullet-proof windscreens had also to be fitted. The rather narrow undercarriage and lightly constructed tail wheel of the Martlet, while none too suitable for our grass airfields, cause no trouble on smooth decks, and the type, which is the fastest fighter possessed by the F.A.A., has proved to be highly efficient, and a still better version is reported to be now in production.

The fuselage of the Martlet is a monocoque construction in aluminium alloy, and the wings are of the monospar type and fitted with vacuum-actuated split trailing-edge flaps. Flush-riveted stressed-skin covering is used for everything except the ailerons, elevators and rudder.

The Martlet's power-unit is a Wright Cyclone G-205A 9-cylinder air-cooled radial engine with a cruising rating of 900 h.p. at 14,000ft., a maximum level power of 1,000 h.p. at 2,300 r.p.m. at 4,500ft., and giving 1,200h.p. at 2,500 r.p.m. for take-off. It has a top speed of 325 m.p.h. at 13,500ft. and a cruising speed of 285 m.p.h. Its service ceiling is 28,000ft., and the range at cruising speed is 1,150 miles.

Its all-up weight is 5,897 lb., which gives a wing-loading of 23.5 lb./sq. ft. and a power-loading of 6.79 lb./h.p.

Walton high speed craft for air co-operation

Fast tenders for service, repair and rescue work
Medium Speed general utility launches

THE WALTON YACHT WORKS LTD.

An engineer makes notes on behaviour of rear gun turret at extremely low temperatures. This picture was photographed through the four panes of glass in the observation window.

Engineers emerging from the cold-room through the double wood-and-cork doors.

ALTITUDE RESEARCH

Additions to the Boeing Stratosphere Laboratory : Simulating Temperature Pressure and Humidity Up to 50,000ft.

By HARRY WILKIN PERRY

STUDY of the effects upon materials and men of the extreme cold and rarefied air encountered when flying at altitudes of six miles or more above the surface of the earth are being made in a ground-level laboratory by the Boeing Aircraft Co. at Seattle, Washington. The research was begun in the spring of 1940, when the original strato-chamber, claimed to be the world's first double-compartment high-altitude chamber, was completed for testing cabin pressure controls on the nine Stratoliners then nearing completion for passenger and mail service on trans-continental airlines.

Military requirements for flight at great height, and various phenomena that have been observed during the war when operating in the substratosphere, necessitated more extensive research. The Boeing Company therefore built a cold-room last winter and added a third compartment to the original two-chamber test tank for

ALTITUDE RESEARCH

making cold tests under low air pressure. This expanded laboratory is equipped for reproducing at ground level all conditions of air pressure, temperature and humidity found at altitudes up to 50,000ft. or more. By the time this description appears in print an icing tunnel in which a frigid air blast can be produced may supplement the equipment and be in use.

Most of the knowledge heretofore acquired regarding the substratosphere and stratosphere was accumulated by means of aircraft flights and balloon ascents to maximum ceilings. It was not feasible, however, to carry aloft on such flights all the equipment and personnel needed for making exact studies of effects produced on various materials and operating units. Moreover, such flights consumed a great deal of time and were very expensive. Hence, the obvious need was for a ground laboratory in which stratosphere conditions could be simulated.

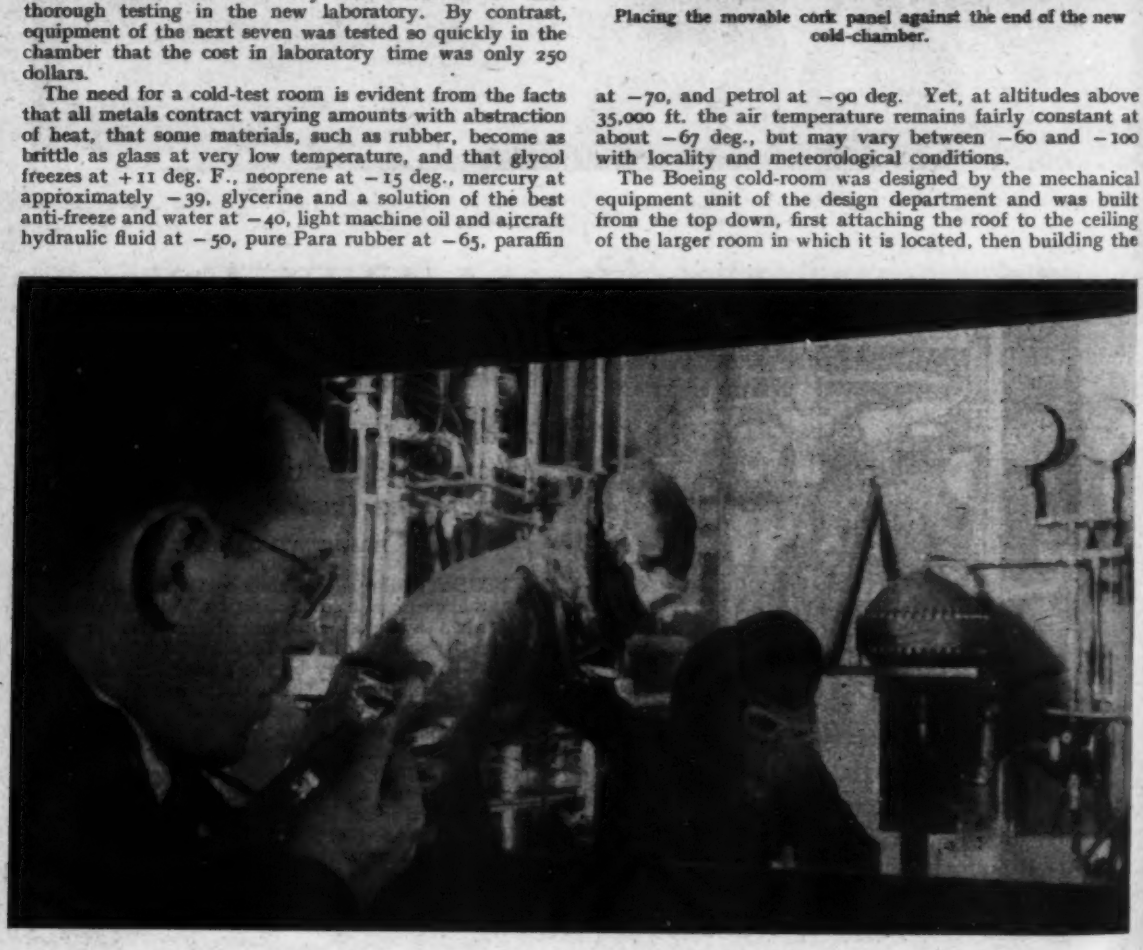
Test Time Saved

The total cost of the original strato-chamber and all the equipment for it was more than paid for by saving of flight test time of the Stratoliners. Flight testing of the cabin pressure controls on the first two of these machines, which were delivered before the chamber was completed, cost 10,000 dollars, and later they were returned for more thorough testing in the new laboratory. By contrast, equipment of the next seven was tested so quickly in the chamber that the cost in laboratory time was only 250 dollars.

The need for a cold-test room is evident from the facts that all metals contract varying amounts with abstraction of heat, that some materials, such as rubber, become as brittle as glass at very low temperature, and that glycol freezes at +11 deg. F., neoprene at −15 deg., mercury at approximately −39, glycerine and a solution of the best anti-freeze and water at −40, light machine oil and aircraft hydraulic fluid at −50, pure Para rubber at −65, paraffin at −70, and petrol at −90 deg. Yet, at altitudes above 35,000 ft. the air temperature remains fairly constant at about −67 deg., but may vary between −60 and −100 with locality and meteorological conditions.

Placing the movable cork panel against the end of the new cold-chamber.

The Boeing cold-room was designed by the mechanical equipment unit of the design department and was built from the top down, first attaching the roof to the ceiling of the larger room in which it is located, then building the



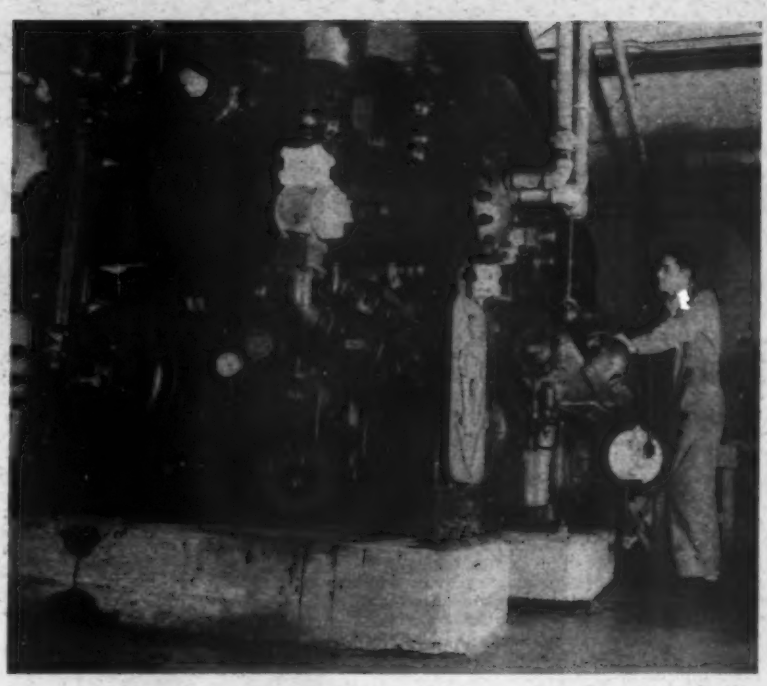
The chief engineer of the equipment unit speaks through a telephone to the engineers inside the cold-room. Those working inside are under constant observation.

cold-room walls and floor, all thickly heat insulated with cork. A large observation window in one side wall is glazed with four panes of glass with sealed dead-air spaces between them.

Mechanical refrigeration of the interior of the cold-room is provided by a machine having a capacity of 108,000 B.T.U./hr. Reduction of temperature within the room, it was soon found, decreased the air density and the partial vacuum created caused warm air from outside to seep through the cork walls. Moisture in the warm air then condensed and froze in the cork, threatening early disintegration of the insulation. This difficulty was overcome by applying two layers of paint each ¼in. thick to the outside of the walls.

Temperature inside the room can be controlled either manually within the room or automatically by a thermostat controlled from outside. Men conducting tests wear electrically heated flying suits, fleece-lined boots, helmets and oxygen masks (as no fresh air can enter the room), and are under constant observation by an outside attendant, with whom they are in telephonic communication.

A large double door of wood and cork in one of the long walls enables large aircraft parts and equipment structures to be taken in and out with convenience. When this is closed for a test, men enter through two successive doors at one end. These doors have an air lock between them to avoid admission of a large volume of warm air. Mechanism was installed for vibrating parts under test in the same way as they are vibrated in an aircraft during flight.



The "Fridge." This refrigerator has a capacity of 108,000 B.T.U. per hour and can reduce temperature in the cold-room to —100 deg. F.

The original altitude laboratory, which was completed early in 1940, is a cylindrical steel tank divided into two compartments joined by a circular hatch. Entrance to the tank is made through a circular door at one end which is sealed tight when closed. There are observation portholes in one side of the tank, on which is mounted an attendant's control board fitted with indicating instruments. Last winter a third compartment, heavily insulated with cork, was built on one end of the tank and connected with the cold-room refrigerating system. When a cold-test is to be run in this new chamber, a big mobile cork end panel is rolled into position and clamped against the end.

This new section can be operated separately or in conjunction with one or both of the other two chambers. Thus, one chamber can be used at ground-level air pressure and temperature and another simultaneosly at stratosphere rarefaction and frigidity. Centrifugal supercharging units driven by two Ford V.8 engines circulate air between the compartments, and electrically driven vacuum pumps are employed for reducing air pressure. Size of the chambers enables the testing of complete aircraft heating, supercharging or hydraulic systems.

Tests that have been completed showed that many items of purchased equipment and even entire systems should be redesigned for most efficient operation at great altitude, and that in some cases new materials must be developed to withstand and to function properly at extremely low temperature. After making physiological tests in the Boeing stratosphere laboratory twice before last February, Drs. Walter M. Boothby and J. Randolph Lovelace, widely known for their research in this field at the Mayo Clinic in Rochester, Minnesota, are said to have declared that the Boeing high-altitude equipment was the most complete in existence.

AIR MINISTER ENCOURAGES YOUTH

"Vigour of Democracy" Typified by Glasgow Rally

"OF all the crimes which the Nazis have committed, the cold-blooded and systematic corruption of German boys and girls, so as to make them the pliable instruments of their foul purposes, is perhaps the most horrible."

This statement was made by Sir Archibald Sinclair, Secretary of State for Air, when he recently addressed an international youth rally in Glasgow.

Sir Archibald referred to those at the rally as "the representatives of youth"—"For the Youth of Britain, of the British Commonwealth of Nations, of India, of the Colonies, and of our heroic Allies for whose courage and undaunted spirit no praise can be too high.

"It is a moving experience to see you all, and to know that whatever your nationality or walk of life, whatever your religious creed or political opinion, you have come together to-day inspired by one spirit—the spirit of service—and one purpose—to win this war, and then to build the peace," he added.

"I can think of no better testimony to the vigour of democracy, so often dubbed degenerate by dictators who cannot understand it, than this action of yours. For you have chosen publicly to pledge yourselves to-day to the establishment of peace, justice and freedom, not for yourselves only, nor for the particular organisation or class to which you may belong, nor even for your own country (though this cannot but be foremost in your thoughts), but for the whole of the world that loves and values these things and also for that part of it which we pray may one day learn to cherish them.

"How different is the outlook in Germany!"

BEHIND THE LINES

Service and Industrial News from the Inside of Axis and Enemy-occupied Countries

French Aircraft for Finland

NEUTRAL sources report that a large proportion of the equipment supplied by the Nazis to the Finnish fighter squadrons operating with the *Luftwaffe* is composed of aircraft of modern French design.

While details of this equipment are not reported, it can be presumed that they originate from the equipment of the French Air Force found by the Germans after the Armistice. It is also likely that they are the product of the aircraft industry working to their own designs in Occupied France.

ITALIAN TORPEDO BOMBER: The Caproni 313S twin-engine bomber and torpedo aircraft is powered by two Isotto-Fraschini Delta RC 35 air-cooled in-line engines of 650 h.p. each.

B.V. 222

THE aircraft division of the Blohm and Voss Shipbuilding Company, of Hamburg, is reported to have supplied the *Luftwaffe* with a number of flying boats for long-range reconnaissance. Designated B.V.222, these aircraft are powered with six B.M.W.132 Dc air-cooled, 9-cylinder radial engines of 1,000 h.p. each.

The B.V.222 is reported to be capable of a maximum speed of 200 m.p.h. at 9,840ft., and a cruising speed of 170 m.p.h. The aircraft has a gross weight of about 45 metric tons, and a range of approximately 4,400 miles.

German Training

THE Nazi Ministry of Education published recently new regulations governing the studies at technical colleges. Students of aeronautics at these colleges have to attend a course of studies for a minimum period of seven terms before they are permitted to stand for the final examination.

Apart from the usual German equivalent to matriculation, a certified practical experience of at least one year is required as a condition of entry, but students with six months' practical training are accepted provided they complete the other six months during their course of study.

"ENGLAND—WE ARE COMING"—reads this sign above the entrance to a German aircraft factory. Meanwhile however, the Nazi aircraft industry has to rely increasingly on slave labour from occupied countries. The couple leaving the factory are M. and Mme. M., from France, and the caption to this picture, published in a German periodical, says that: "They can consider themselves lucky to have found accommodation where they can live together. . . ."

Before passing to the fifth term, students must submit to an additional preliminary examination; successful candidates are allowed to proceed farther with their studies, which in the last three terms are devoted to specialised knowledge. This senior course is divided into three branches, e.g., airframe design and construction, engine design and construction, flying technique and airport control, each of which can be chosen by the student for his specialisation.

While the technical colleges of Berlin and Brunswick offer facilities for the study of any of these specialised branches, a number of other colleges, such as those at Aix-la-Chapelle, Vienna, Munich, Breslau and Danzig, instruct only in airframe design and construction.

From France

THE well-known French aircraft firm, S.A. des Ateliers d'Aviation Louis Breguet, which controls a number of plants in Paris, Toulouse and elsewhere, has recently acquired a controlling interest in the Société Générale de Méchanique et d'Aviation. The latter company has been engaged in the development of large commercial aircraft.

In this connection it will be remembered that the Breguet Company exhibited at the last Paris Show a model of a four-engined transport aircraft with a carrying capacity of 24 passengers. It is quite likely that the new acquisition of the Breguet Company is aimed at developing a production based on this Breguet 731.

JAP JUJITSU: Trainees at a Japanese naval air school practising wrestling.

Jap Planning

AT a special meeting of the Japanese cabinet plans were adopted for the further expansion of Japanese war production. The comprehensive planning for 1943 embraces the entire Japanese Empire and places particular emphasis on the development of the available raw materials. The Japs appear to be particularly perturbed by their transport problems, and for this reason the construction of ships is to be intensified, and special measures are to be taken to secure the supply of necessities for the civilian population.

The Jap cabinet has also devoted considerable attention to the improvement of air-raid precautions and anti-aircraft defences of important production centres.

Topics of the Day

SCALE EFFECTS

Should More Use be Made of Flying Scale Models? : The Need for New Ideas in Design

IT is difficult not to feel enthusiastic about the idea of the flying scale model considered as a prototype, but I often wonder whether, in fact, very much can be discovered which cannot be found equally well by using a wind-tunnel. Equally well, that is, proportionately to the relative cost of the experiments. While there are all kinds of queer characteristics which only appear, so to speak, in real life, there must be an equally large number which will not, for reasons of reduced scale, appear in the flying model, and its object is, therefore, very largely lost.

Individual items in design, such as flaps, wing sections, and so forth, can be tried out—with a reasonable hope of discovering most of the snags—on other established types before they are "built into" a new type, and general design should not now provide very much in the way of surprises. Since scale effects must, in any case, be provided for, it does not seem to matter so very much whether the differences are small, as in the case of the flying half-scale model, or large, as in the case of the sort of models which are used in wind-tunnels. Furthermore, the inevitable detail differences in the flying model—in which differently shaped power units, and so on, must necessarily be used—will probably outweigh in their effects those of sheer size.

Cost and Time Factors

Nevertheless, as I say, the idea of the flying scale model is most attractive, and much greater use might be made of it in the development of any entirely new layouts. If only the cost and time factors were not so great and so important it is probable that a great deal more would be done, even in wartime, along new and untried lines. Using wood construction and small available power units there would be very little loss in man-power and materials, even if every firm in the country set about the business of making at least one strange aircraft every year. And things would undoubtedly be learnt, even if the types themselves turned out with more faults than any virtue could justify.

After the Short flying model and the models of French flying boats of pre-war days we heard very little of the flying model *per se*. Some long time ago there was the De Havilland T.K.5, a tail-first affair, with which very little has been done since its early ground runs, and which is now, I believe, resting ingloriously under a dust cover at Hatfield. And now there is the Northrop tailless machine.

In those two models—if you can thus designate a machine which is powered by one or two medium-sized motors—the ideal of cheap, small-scale experiment has appeared, and I would like to see a very great deal more of it. You can learn very little when cost and production needs limit the designer's horizon, but there is no reason why every designer should not have a little "corner" in model flying, even if the work must be done by himself and his staff in their spare time (if any), and the flying done, out of sheer *joie de vivre*, by the firm's test pilots at their own risk.

Fore and Aft Control

I don't know very much about the later experiments with the Northrop, but apparently it flew quite well. The only real difficulty concerned fore and aft control at high, or comparatively high, speeds. As one might expect, there was some trouble in making this tailless affair stop going downhill once it had been set good and well on its way. Presumably the fore and aft "leverage" was insufficient, and I've no doubt that the flexing of the wing tips made things even more difficult.

All of which is mere hearsay, and I, for one, would be more than glad to hear that the troubles, if any, have been overcome. I've always thought that until we can get right away from conventional ideas, both in aircraft and engine design, we shall not get very much farther along the road of progress. Everything we do now is done only by refinements to existing ideas and designs, and the present-day aircraft is basically similar to that with which the Wrights flew nearly 40 years ago.

Since then the trend has gone from biplanes to monoplanes and back to biplanes and on to the cantilever monoplane with flaps and all the rest of it—and the engines have been made to develop more and more power for less and less weight—but nothing has been basically altered. An aircraft is still lifted by its own drag and is pushed along by a screw driven round by a strange explosion engine of no great efficiency or merit—other than its refined and magnificent complication, from sodium valves to two-stage, two-speed blowers.

Trying New Ideas

Of course, if somebody said, "Well, you clever fellow, go ahead and do better," I should just grin sheepishly and admit that I couldn't. All the same, the fact remains, even if my criticism is only destructive. I merely hope that a lot of much cleverer people will get the chance of playing with flying models in their spare time and of using every crazy, but carefully checked, idea that comes into their heads. If the idea is sufficiently well checked in each case, the valuable test pilot should come to no direct harm. He will merely report the aircraft to be hopeless or hopeful as the case may be.

Things *are* happening here and there, and nobody is allowed to talk about the latest developments—which have gone a good deal beyond the model stage. But that is no reason why lots of other people shouldn't have the chance of hurrying along on their own pet lines for better or for worse.

And the small, carpentered aircraft of 100 h.p. or so seems to be the ideal way of trying things out. Needless to say, wing-loading and so forth will have to be scaled down, too, or we shall have completely unmanageable little beasts as dangerous and as tricky as some of the contraptions which were flown in the National Air Races at Cleveland. The models will be essentially for trying out *ideas* and can be made with high factors of safety and comparatively low wing loadings, so that even failures near the ground, due, perhaps, to insufficient control, and so forth, while making preliminary "straights," are not likely to be fatal.

New ideas are certainly wanted, and the only way to try them out cheaply and effectively is to bring them to life in miniature.

"INDICATOR."

R.A.F. Exhibition

A SERIES of air exhibitions each containing some 300 R.A.F. photographs and a number of working models, illustrating the R.A.F. in action, will be on view in the principal cities of Great Britain and Northern Ireland during the coming months.

Bristol, where the first exhibition was recently opened, has already given a popular welcome to the show. Last week a similar exhibition opened at Sheffield, and others will be on view at Newcastle and at Dundee. Londoners will be able to see the photographs and models later at a central gallery. The exhibition will remain open for about a fortnight in each case.

Many of the photographs are large-scale enlargements of pictures taken over enemy and occupied countries, the Western Desert, Atlantic, Iceland and other theatres of war in the air. The R.A.F. Commands are grouped so as to show the characteristic activities of each and there are series of pictures showing the work of the Air Sea Rescue Service, the W.A.A.F., A.T.C., Royal Observer Corps and allied services.

BATTLESHIPS or CARRIERS?

The Latest American Shipbuilding Programme : Lessons of Coral Sea and Midway Battles

By MAJOR F. A. de V. ROBERTSON, V.D.

THE change in the United States naval building programme, as a result, we are told, of the lessons taught by the battles of the Coral Sea and Midway Island, makes one hope that the Americans have not jumped too hastily to conclusions. Mr. Vincent, chairman of the Naval Affairs Committee, is reported to have said that events had proved conclusively that "the aircraft carrier was the backbone of the fleet."

According to the reports so far published, in each battle there was little or no ship-to-ship fighting, and the losses inflicted by both sides were wrought by aircraft. The Americans had much the best of the exchanges; in fact, they won two splendid victories. These battles, it should be noted, were not in the same class as that in which H.M.S. *Prince of Wales* and *Repulse* were sunk. Then the British warships had no air assistance at all, and it is now generally recognised that an air component is as necessary to a fleet as are destroyer screens or any other of the various naval weapons now employed. Admiral Sir Andrew Cunningham, for example, has recently said that "an indispensable ingredient of sea power in modern war is the air."

Both in the Coral Sea and at Midway Island the Japanese fleets were not without that indispensable ingredient. In the Coral Sea two Japanese carriers have been mentioned, the *Ryukaku*, which was definitely sunk, and the *Shokaku*, which was set on fire. There were probably others, for the Japanese have never shown a niggardly spirit in the use of their carriers. At the Midway battle they seem to have had at least five of these craft, and, again, there may have been more, for the American pilots have claimed five as sunk or badly damaged. At the second battle the Japanese had at least three battleships present, all of which were damaged, while nothing has been published about the American naval strength in either battle. We only know that their great 35,000-ton carrier *Lexington* was sunk in the Coral Sea.

Shore-based and Ship-borne Aircraft

Great stress has been laid in some quarters on the fact that at Midway the Americans were able to use shore-based aircraft, and that such machines must always be superior to carrier-borne aircraft. Class for class, this is undoubtedly correct. Shore-based bombers can carry a heavier load of bombs than ship-borne bombers can carry. Land-based fighters of the short-range class ought always to be superior to the fighters which can be stowed in the hangars of a carrier. Moreover, if some reports about the Malayan fight are to be credited, the two British warships were sunk by Japanese aircraft which discharged more powerful torpedoes than the 18in. variety which are the standard load not only of the naval Swordfish and Albacores but also of the Beauforts. The Grumman Avenger, which was used by the Americans for the first time in the Midway battle, may carry a still more powerful torpedo than any previously discharged from aircraft.

But air supremacy is a matter of fighters, and, according to all precedent and theory, the fighters from a carrier, or rather from several carriers, ought to be able to give substantial protection to a fleet against the attacks of bombers and torpedo-aircraft, even though the latter are based on the land. Unless the action occurs close to the land, the bombers cannot have escorts of short-range fighters, which are the most formidable of all, and the carrier-borne fighters ought to be able to deal with long-range fighters from the shore. At the very least, they ought to be able to put up a good enough fight to prevent the shore-based machines from achieving clear supremacy in the air. A slight superiority by the American short-based machines, so long as that superiority was resolutely contested, ought not to have left the Japanese fleet completely at the mercy of the Americans, as it seems to have been off Midway. In the Coral Sea the Americans effected a surprise, but they can hardly have repeated it at Midway.

The Probable Lesson of Midway

So far as the facts are known at present, the conclusion to be drawn from Midway would appear to be, not that the American air strength proved inevitably stronger than the Japanese fleet, but that the Japanese Admiral showed lack of enterprise and skill. With at least three battleships and five carriers at his command he surely ought to have been able to get within gun range of the American warships. The Americans won the two battles by air power alone, and yet neither was a clear-cut case of air *versus* navy, for there were considerable air forces on both sides in each case.

If, however, further information proves that the American victory at Midway was due to the shore-based aircraft which were able to intervene, that hardly makes a case for proclaiming the carrier as "the backbone of the fleet." In their earlier operations, e.g., Pearl Harbour, the Japanese have been very clever and very daring in the use they have made of their carriers, but these ships are undoubtedly vulnerable, and the Japanese have suffered even heavier losses in this class than the Americans and we ourselves have suffered. In any case, the exploits of the Japanese carriers have always been based on the supremacy of the Japanese battle fleet in the Pacific. Naturally, the disposition of the American battleships has not been disclosed, but it is commonly supposed that the majority of them are in the Atlantic. If the Japanese battle fleet were disposed of, the tentacles of the octopus, spread out as they are throughout the Pacific, the Indian Ocean, Indo-China, Siam and Burma, would be left limp and lifeless, cut off from all supplies, and unable to advance or retreat. Even the narrow seas between Nippon and China would be dominated by the sea power of the United Nations.

Battleships Provided

All these considerations, however, do not mean that the naval authorities in the United States have lost their sense of proportion, whatever Mr. Vincent may have said. They have not decided to provide no more battleships; several are already in hand and some of them will be launched this year. The programme already in hand

will provide the United States with the two-ocean Navy at which President Roosevelt has been aiming. The laying down of the keels of further battleships has been postponed, but not necessarily cancelled. We all devoutly hope, and indeed expect, that the Axis will have been defeated before those extra American battleships could have been ready to take their places in the line, and for that reason it is only sensible to concentrate all shipbuilding energies on cruisers and carriers, which will be able to assist in winning the present war.

Carriers Very Vulnerable

The chief change to be provided for in the present programme is the conversion of some cruisers already partially built into aircraft carriers. This is certainly a wise move. The proper sphere for the operations of a carrier is a great ocean, and none is more suitable than the Pacific. They are vulnerable vessels, and they run special risks when operating in narrow seas. The carriers of the Royal Navy have suffered losses, some sunk and others damaged, because circumstances have obliged us to use them in narrow seas even though our naval authorities have known that to do so was not ideally correct. The Italians decided before the war not to build any carriers, but hoped to control the Mediterranean with shore-based aircraft. The exploits of H.M.S. *Eagle*, *Illustrious*, *Ark Royal* and *Formidable* made it appear at one time that the Italian judgment had been wrong. Yet it has received support from no less an authority than Admiral Sir Andrew Cunningham. In his review of his command in the Mediterranean which he gave on May 26th last, he spoke of aircraft as an indispensable weapon of the Navy, and went on to say, "When great distances are involved this weapon must be transported in carriers, but in confined spaces like the Mediterranean it can be shore-based, given suitable aircraft and technique." Useful as they were, not one of the above-mentioned carriers escaped damage to a greater or lesser degree.

Mastery Depends on Battleships

Even in the Pacific there has been no little slaughter of carriers, and the Americans are wise to increase the number in their Navy, not only for the purpose of extending their operations, but also to provide a reserve in case of further losses.

Nobody knows for certain how many carriers the Japanese Navy had at its command when that country entered the war, for its building programme had been a well-kept secret. But since the fighting began it has lost a substantial number of carriers. The Japanese shipyards have no power of replacement on a large scale in a short time. There can be little doubt that the American Pacific fleet will in due course outnumber that of the Japanese in carriers as well as in other classes of warship. The ultimate mastery of the Pacific depends on battleships duly supported by warships of other classes, and in that respect, too, we have full confidence in an American victory. The contingency must also be faced that the carriers, vulnerable as they are, may cancel each other out. In that case the task of the superior battle fleet will be simplified. Major Seversky, the Russo-American aircraft designer, foresees a time, not too distant, when shore-based aircraft will be able to cover the whole Pacific and even the whole world, but that time is not yet. We should also remember that, however the range of bombers and special fighters may be increased, the short-range fighter will still be superior in combat to any long-range class of aircraft.

Sensible Realism

The Americans plan also a great increase in cruiser strength. That likewise appears to be sound sense. In a large ocean there is always plenty of work for cruisers to do, and as they all carry aircraft they can quickly reconnoitre wide stretches of water. When the Japanese battle fleet is no longer in a dominant position, it will doubtless be the task of American cruisers to cut off all supplies to the numerous land forces which Japan has so lavishly strewn about the islands of the Pacific and parts of the mainland of Asia.

On the whole, the United States programme seems inspired by sensible realism, not by any fanciful theories that the newest weapon has consigned all previous weapons to the scrap heap. The weapons of sea power are always changing, but the changes only affect tactical measures. The basis of sea power remains unaltered.

UNCENSORED BROADCAST

WHEN pilots of one of the Royal Canadian Air Force Spitfire squadrons in Great Britain go into action, the ground crews are much too impatient to wait for their return in order to get news on the operation. Instead, they have fixed up a radio set which can pick up the messages flashing between the aircraft as they speed into the fray, and frequently even while combat is in progress.

Whenever the squadron goes off on an operational flight, the ground crews cluster around the loudspeaker of this receiving set and listen breathlessly to the messages which it picks up. Often they can get a pretty good idea of the combat in which their squadron's Spitfires are taking part.

Responsible for the scheme are Sergeant John (Jack) Moffat, of Regina, Sask., who is in charge of the unit's wireless section, and his two assistants, Corporal George Mellen, of Montreal, Que., and Corporal Ernest Miller, of Quebec City, Que.

A radio set similar to those used in the Spitfires themselves, and mainly intended for use by the squadron wireless section in testing work, picks up the messages transmitted from the aircraft. The receiver is connected with the amplifier so that many men can listen at one time to the loudspeaker instead of having to listen individually through earphones.

"On days when reception is good, and when the aircraft are flying high, we can listen-in up to quite surprising distances," says Sergeant Moffat.

"Often we can hear one member of the squadron shouting a warning to one of his comrades: 'Look out, there's a Messerschmitt right on your tail!'

"If there's a big show on, the excitement gets pretty keen around here. The boys who have to stay on the ground think it's swell to listen-in when the squadron is really engaged on a job. It helps the ground crews, too, because they know when the aircraft are coming back and so can be ready for them."

Often, the uncensored nature of what comes out of this particular loudspeaker makes it one of the most entertaining radio programmes in existence. One day, when one member of the squadron was making his circuit preparatory to landing after returning from a show, another aircraft cut across his path. "If you don't get out of my way, you ——!" roared a wrathful voice out of the loudspeaker. "I'll heave you into the lake the moment I get down. . . ."

IN PARLIAMENT

"Gongs" and Class Distinction : Time Put in by Civil Pilots : Flying Boat Incident : What Some Said in 1941 : Petrol for R.A.F. Personnel : Skilled Fitters in Unskilled Jobs

Awards for Gallantry

Mr. Ammon asked the Secretary of State for Air in what manner did the non-commissioned flying officers, recently decorated for their part in the recent raid on Lubeck, differ in responsibility, initiative or courage from the commissioned officers who were given awards for their part in the same operation.

Sir A. Sinclair: Their conduct was of equal merit, and so were their awards.

Mr. Ammon: Why were they given a different award?

Sir A. Sinclair: They were given awards of equal merit.

Mr. Ammon: Has the right hon. gentleman seen the scathing comment on his replies concerning this matter in *Reveille*, a paper which circulates among the men of the Air Service?

Mr. Shinwell: Why is the right hon. gentleman so sticky about this? Why does he not respond to public feeling and grant a distinction which is fair to everybody?

Sir A. Sinclair: There is no question of stickiness. These awards are equal. The D.F.M. is an award which is cherished by those who receive it. [HON MEMBERS: "Hear, hear."]

Mr. Shinwell: Does not the right hon. gentleman appreciate that the cheers from hon. Members behind him indicate their desire to retain class distinction?

Sir A. Sinclair: I heard cheers from all over the House.

B.O.A. Pilots' Flying Hours Exceeds Regulations

Wing Cdr. Grant-Ferris asked the Secretary of State for Air whether he is aware that many British Overseas Airways Corporation pilots are flying many more hours per month than are allowed by the regulation; that one has flown, approximately, 200 hours in 14 days recently; and what steps are being taken to relieve these pilots.

Sir A. Sinclair: The regulations provide that a holder of a licence who has completed 125 hours flying as a pilot in any period of 30 days should be medically examined and pronounced fit before continuing to fly. Wartime requirements necessitate from time to time that pilots should fly more than 125 hours a month; the average is less than this figure. I have no information which suggests that the regulations are not complied with generally, or as to the particular case referred to in the second part of the question. If my hon. and gallant friend will let me have details, I will have enquiries made.

Sick Passengers Delayed

Wing Cdr. Grant-Ferris asked the Secretary of State for Air why the British Overseas Airways Corporation's flying-boat *Clare* was left riding at anchor for 1¾ hours on May 26th, when it was known to the British Overseas Airways Corporation authorities on shore that passengers were seriously ill; and will he take steps to avoid similar occurrences in future.

Sir A. Sinclair: The circumstances of this incident are being looked into, and I will communicate with my hon. and gallant friend in due course.

Dive-bombers

Mr. Ellis Smith asked the Secretary of State for Air whether he can give the date on which orders for dive-bombers were given; is he satisfied that adequate supplies of dive-bombers will be provided within a reasonable time; and can he make a statement on the Air Ministry's policy on dive-bombers and torpedo-carrying aircraft.

Sir A. Sinclair: As I informed my hon. friend on May 20th last, dive-bombers were ordered in July, 1940. As to the second part of the question, I can only say that squadrons of the Royal Air Force will be equipped with dive-bombers as soon as they are received from the United States of America. With regard to the last part I cannot usefully add to the statements which I made in introducing the Air Estimates and in replying to the debate on that occasion.

Mr. Smith: Can the Minister state how he reconciles that reply with the statement made by the Minister of Aircraft Production on July 10th, 1941, that up to that date he had not received any orders to provide the Air Force with dive-bombers; and can he also reply to the question whether the Air Force, the Army and the Navy will be provided with adequate dive-bombers within a reasonable time.

Sir A. Sinclair: The Minister of Aircraft Production assures me that there must be some mistake about that statement, which I cannot recollect myself. At any rate, I am not responsible for what the Minister of Aircraft Production said in July, 1941. I can only tell my hon. friend the facts as I know them and as I have given them.

Mr. Smith: It is here in the OFFICIAL REPORT, and, therefore, I want to ask whether there should not be an enquiry as to who is responsible for this serious position with regard to the provision of dive-bombers and torpedo-carrying aircraft.

Sir A. Sinclair: The answer to that question is, as I have told my hon. friend more than once and as my right hon. and gallant friend the Minister of Aircraft Production has told the House more than once, that dive-bombers were in fact ordered in July, 1940.

Petrol Allowances

Mr. Beverley Baxter asked the Secretary of State for Air whether he is aware that the new restrictions on petrol allowances are particularly hard on members of the Royal Air Force, who are often posted at airfields in comparatively remote districts, and who now lack transport facilities for reasonable recreation and change; and what steps he is taking to remedy this, in view of the undesirability, from a psychological standpoint, of air crews being forced to stay at their stations when off duty.

The Secretary of State for Air (Sir Archibald Sinclair): It is not the intention, when the basic petrol ration is abolished, to discontinue the special issues of petrol and the cheap transport facilities at present available to R.A.F. personnel for the purpose of leave and recreation. The consideration to which my hon. Friend refers in the second part of his Question will, therefore, be met as far as circumstances allow.

Mr. Baxter: Is my right hon. Friend aware that the pilots themselves do not know about this facility, and that they are greatly worried about the matter and have made representations to many of us in this House? Is it clear that stood that pilots can get some transportation to a nearby town to obtain recreation, instead of having brooding in a place from which want to get away?

Sir A. Sinclair: I dealt with my hon. Friend's Question. He has now put the question of transportation to a neighbouring town. The position is that we give facilities in Service transport carrying air crews to the nearest town once a week, provided that the station is more than two miles from the town. As regards lack of knowledge of these matters, I am sure all members of air crews can obtain the information from their station commanders, and I think the effect of my hon. Friend's Question will be to give the publicity he desires.

Mr. Baxter But once a week does not meet the situation at all. A pilot may be at the station three or four weeks without ever being free on that day.

Sir A. Sinclair: I assure my hon. Friend that the position is not that the transport is available only once a week and that if the man cannot take it then he misses it. He has a right to obtain these facilities.

Release of R.A.F. Fitters

Mr. A. Edwards asked the Secretary of State for Air how many fitters have been released for industry during the last twelve months.

Sir A. Sinclair: The number of Royal Air Force fitters who have been temporarily released for industry in the past twelve months is 5,867.

Mr. Edwards: Is it a fact that these men have in most cases had very expensive training, at considerable cost to the country, and that they were led to suppose that their release would result in their being used in some way on the work for which they were trained? Can the right hon. Gentleman explain why very large numbers of these men have been put to unskilled labour?

Sir A. Sinclair: I made it a condition before these men were released that they should be employed in such work as would give scope for the skill they had acquired, either in civilian employment or in the Royal Air Force.

Mr. Edwards: The right hon. Gentleman has admitted that they are not all being employed in that skilled capacity. What steps is he going to take to see that they are so employed?

Sir A. Sinclair: That is a question that should be addressd to the Minister of Labour.

MORE BIRTHDAY HONOURS

Awards to Members of the Aircraft Industry and R.A.F. Personnel : Seven Commendations to British Overseas Airways and Ferry Command

ADMIRALTY

DISTINGUISHED SERVICE CROSS

Temp. Sub. Lt. (A) A. M. Tritton, R.N.V.R..

DISTINGUISHED SERVICE MEDAL FLEET AIR ARM

P/O. Airman A. Jopling; Pty/O. Airman A. W. Sabey; Ldg. Airman N. Leslie; Ldg. Airman F. R. R. Lowe; Ldg. Airman R. S. Saunders; Ldg. Air Fitter B. E. Cawdron; Ldg. Air Fitter W. Jones.

ROYAL AIR FORCE

W. H. Holbrook.

A.R.R.C.

PRINCESS MARY'S ROYAL AIR FORCE NURSING SERVICE

Sen. Sisters H. Adams; E. W. Holbrook; R. M. Whyte; Sister M. Callum.

ROYAL AIR FORCE

MILITARY CROSS

A. G. Douglas.

TO THE AIR FORCE CROSS

Cdr. J. W. McGuire, A.F.C. (deceased).

AIR FORCE CROSS

Capt. P. C. Livingston, M.C.; Wing Commanders J. C. Mac-Gregor, D.F.C.; H. P. Simpson, M.M., W. P. Whitworth; R. H. Act. Wing Cdr. R. H. Winfield; Squadron Leaders H. B. Bell-Syer, R.A.F.O.; C. W. Bromley; H. G. Goddard, D.F.C., R.A.F.V.R.; H. J. F. Le Good; W. E. L. Lewis; B. G. Meharg, R.A.F.O.; R. J. Sage; I. G. Statham, R.A.F.V.R.; J. R. Tobin; Act. Squadron Leaders E. B. Bright; W. R. Greenslade; K. C. Roberts, R.A.F.O.; R. S. Sikes, R.A.F.O.; Flight Lieutenants T. R. Burne; J. M. Ennis; A. G. Hall, R.A.F.O.; O. V. Holmes, R.A.F.V.R.; T. H. A. Lewellyn, R.A.F.V.R.; A. O. Moffet; E. W. Tacon, D.F.C.; Act. Flight Lieutenants R. G. Addy, R.A.F.V.R.; I. B. Butler, R.A.F.V.R.; G. A. Clarke; L. J. Flack, R.A.F.V.R.; W. A. A. Read, R.A.F.V.R.; H. W. Ward, R.A.F.V.R.; Flying Officers P. A. Kleboe, R.A.F.V.R.; N. J. Wheeler, R.A.F.V.R.; C. Wright; Pilot Officers J. Archer; A. A. Rollo; R. A. Studd; Warrant Officers L. S. Millen, D.F.M., R.A.F.V.R.; W. G. Ross; J. E. Sunderland.

ROYAL AUSTRALIAN AIR FORCE

Act. Wing Cdr. W. R. Garrett; Squadron Leaders E. W. Cooper; C. R. Gurney; W. L. Leer; Act. Squadron Leaders F. Neale; H. Plumridge; Flight Lieutenants J. L. Grey; G. E. Hemsworth, M. V. Mather.

ROYAL NEW ZEALAND AIR FORCE

Wing Cdr. D. W. Baird; Flt. Lt. E. B. Firth.

AIR FORCE MEDAL

Flight Sergeants J. R. J. Belson, R.A.F.V.R.; R. W. Birchall, R.A.F.V.R.; J. R. Emmerson, R.A.F.V.R.; W. H. L. Grant (now Warrant Officer); J. E. Sainsbury; R. D. Stirk; Sergeants L. Larson; T. S. White, R.A.F.V.R.; Cpl. A. P. S. Fiminster.

ROYAL AUSTRALIAN AIR FORCE

Sgt. N. A. Boddington; Cpl. J. S. Lyall.

ROYAL NEW ZEALAND AIR FORCE

Sgt. A. A. Hodder.

AIR FORCE CROSS

Wing Commanders C. P. Dunlop, R.C.A.F.; R. H. Waterhouse, R.A.F.; L. E. Wray, R.C.A.F.; Acting Wing Commanders R. L. Burnett, R.A.F.; C. Scragg, M.B.E., R.A.F.; Squadron Leaders R. D. Byers, R.C.A.F.; F. M. Milligan, R.A.F.; Flight Lieutenants J. Hone, R.C.A.F.; J. P. Rae, R.A.F.O.; J. H. Roberts, R.C.A.F.; N. E. Small, R.C.A.F.; E. M. Williams, R.C.A.F.; Flying Officers F. H. A. McNeil, R.C.A.F.; R. L. Rizon, R.C.A.F.

AIR FORCE MEDAL

Flt. Sgt. (now P/O.) A. N. Hornby, R.A.F.; Sgt. (now P/O.) E. A. H. Bacon, R.A.F.; Sergeants A. J. Chandler, R.C.A.F.; A. Deeks, R.C.A.F.; Cpl. L. G. Harvey, R.C.A.F.; L.A/C. W. J. Hunt, R.C.A.F.

BRITISH EMPIRE MEDAL (MILITARY) FLEET AIR ARM

Ldg. Air Fitter P. Allen.

ROYAL AIR FORCE

Flight Sergeants G. J. W. Abraham; T. W. Atkinson; E. W. Belgrove; H. Blackburn; L. E. Cowan, D.F.M.; H. Forrest; W. J. Graham; R. L. Hoey; I. N. Jones; E. H. Leonard; H. J. Moule; C. T. Nicholls; F. T. Salmon; F. Smith; N. Watson; S. H. Lonsdale; Sergeants W. R. Jones; H. K. Pask; Corporals R. E. Butler, A.A.F.; M. J. Edmonds; K. Hall; A. O. Molson; W. Paul; D. A. Purser; Leading Aircraftmen H. Beesley; H. Burke; J. Murphy; R. Stenhouse; A/C.1 D. R. B. Browning.

W.A.A.F.

Flight Sergeants I. L. Millet; J. M. Shannon; E. Vaughan: L/ACW D. M. Nichol.

ROYAL CANADIAN AIR FORCE

Flight Sergeants J. R. Burdes, R.C.A.F.; G. F. G. Gayton, R.C.A.F.; J. H. Haime, R.C.A.F.; W. E. S. Weir, R.A.F.; Sergeants A. W. Appleby, R.C.A.F.; C. W. Boughner, R.C.A.F.; E. Gowda, R.C.A.F.; Corporals T. A. Calow, R.C.A.F.; A. S. Hayton, R.C.A.F.; W. H. Smith, R.C.A.F.; L.A/C. A. E. Sinclair, R.C.A.F.

BRITISH EMPIRE MEDAL (CIVIL)

W. L. Allardyce, Chief Works Foreman, The De Havilland Aircraft Co., Ltd.; H. H. Bagshaw, Head Foreman, Vickers Armstrongs, Ltd., Southern Works; F. W. Ballard, Principal Foreman of Stores, No. 14, Maintenance Unit, R.A.F.; R. Bland, Waste Engineer, Boulton Paul Aircraft, Ltd.; D. B. Cummings, Station Engineer, Grade I, Air Min.; S. J. Damsell, Foreman, The Bristol Aeroplane Co., Ltd. (Aircraft Engine (Production) Department);

Mr. G. Watson, of the Blackburn Aircraft Company, who receives the British Empire Medal (Civil). He joined the firm in 1909 and served with the Royal Naval Air Service from 1914 to 1918. Since leaving the Service he has been in charge of all experimental and development work at Blackburn's.

H. E. Day, Foreman of Milling Department, D. Napier and Sons, Ltd.; M. T. Driscoll, Foreman in charge of Hull Shop, Saunders-Roe, Ltd.; A. J. Earley, Toolmaker, Westland Aircraft, Ltd.; T. Entwistle, Foreman Millwright, Armstrong Siddeley Motors, Ltd.; W. C. Finnern, Class "A" Observer, Southern Area, R.O.C.; F. W. A. Goodchild, Fireman, B.O.A.C.; E. S. Harris, Head Observer, Western Area, R.O.C.; L. Higham, Chargehand Erector, Vickers Armstrongs, Ltd.; H. T. Hull, Woodworking Superintendent, Phillips and Powis Aircraft, Ltd.; W. H. James, Station Engineer, Grade I, Air Min., Middle East; A. K. Laverton, Maintenance Engineer, Gloster Aircraft Co., Ltd.; W. E. Mee, Chief Foreman of Metal Detail Department, The Bristol Aeroplane Co., Ltd. (Aircraft Works); J. W. Nicholson, Chargehand Fitter, Vickers Armstrongs, Ltd.; H. J. Pallister, Overseer, Air Min. Wireless Station; J. B. Patterson, Foreman of the Flight Shed, Short and Harland, Ltd.; Miss L. G. Silvernie, Press Tool Setter, Vickers Armstrongs, Ltd.; A. E. Smith, Shop Foreman, No. 19 Maintenance Unit, M.A.P.; G. Watson, Foreman, Experimental Shop, Blackburn Aircraft, Ltd.; A. F. West, Senior Foreman, Short Brothers Seaplane Works; S. Wicks, Shop Foreman, No. 8 Maintenance Unit, M.A.P.

COMMENDATIONS

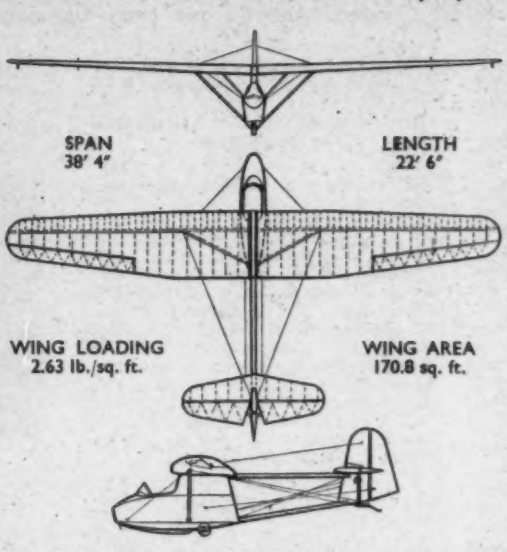
C. L. Cheeseman, Radio Officer, B.O.A.C.; F. W. Holland, Civilian Armament Instructor, R.A.F., F.T.S. (now A/C.2, R.A.F.); G. G. Lambert, Third Engineer, B.O.A.C.; Flt. Capt. N. Pelley, B.O.A.C., Cairo; E. W. Smith, Steward, B.O.A.C.; Capt. L. Bisson, R.A.F. Ferry Command; Capt. D. M. McVicar, R.A.F. Ferry Command.

DE HAVILLAND GLIDER

Prototype Designed and Built by Canadian D.H. Employees in Their Own Time

LEST the title of this article should raise too previous hopes in the breasts of enthusiastic A.T.C. personnel, it should be stated right at the outset that it refers to the de Havilland Aircraft Company of Canada, and that the glider illustrated on this page and about to be described was designed and built by spare-time volunteers from the ranks of the company's employees.

But the project had the blessing of the management, who not only permitted the firm's workshops to be used, but also provided materials and funds to be expended on production costs. And while it is perhaps a little too early to announce that the resultant de Havilland glider has "gone into production," it is, nevertheless, reported that another group of volunteers has started manufacturing glider parts in the company's experimental department.



Gliding Club Formed

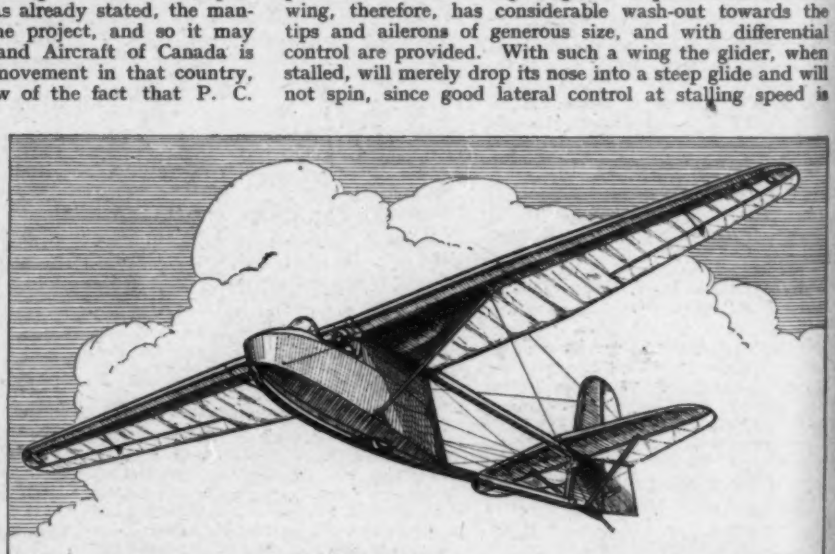
The sport of gliding and soaring is, to all intents and purposes, non-existent in Canada at the present time, but since it could hardly be doubted that the military authorities would look favourably upon its development in view of its obvious value, it occurred to W. Czerwinski, one of the de Havilland engineers, that it might be a good idea to do something practical about the matter. Accordingly he, with the keen support of other members of the engineering department, formed a glider club with the avowed object of initiating and stimulating interest in the sport of gliding in the Dominion. As already stated, the management cordially approved the project, and so it may safely be said that de Havilland Aircraft of Canada is responsible for launching the movement in that country, which is not surprising in view of the fact that P. C. Garratt, their managing director, and W. J. McDonough, director of operations, are themselves pilots and fully appreciate the importance of glider development.

No time was lost in getting down to the job of designing their first glider and producing the requisite set of drawings. The work was carried out by members of the drawing office staff, in their own time, under the direction of Mr. Czerwinski, and, working twice a week for several hours each day, the drawings were completed in about six months. By the time the actual design of the glider was settled, other firms had begun to show an interest in the project, with the result that Canadian Aircraft Instruments and Accessories, Ltd., donated a set of flying instruments, and Dunlops made them a present of the single wheel for the landing gear.

In designing the de Havilland glider, consideration had to be given to local conditions, the most significant aspect of these being that there are no hills in the vicinity of Toronto where it will be used for training. A better gliding angle than that usually found in the primary training glider was therefore desirable, since it was hoped that, with a towed launch by motor car, sufficient altitude could be attained to give flights of useful length over flat country. Further than that, the designers also had in mind the fact that strong thermal currents exist in the Toronto area during summer so that, with good aerodynamic properties, the glider could take advantage of these to make soaring flights.

This combination of primary training and sailplane is very unusual, and it is hardly to be hoped that the de Havilland glider can possess the sheer efficiency of an out-and-out sailplane, but in view of the unusual intensity of local thermals it is expected that a reasonably satisfactory compromise will be achieved.

One of the most important points which has been stressed in the design has been the safety factor. Remembering that the student glider-pilot takes to the air alone (there have been very successful two-seater gliders with dual control, but the majority are single-seaters as in this instance), special attention was paid to the elimination as far as possible of the aircraft getting into a spin if stalled. The wing, therefore, has considerable wash-out towards the tips and ailerons of generous size, and with differential control are provided. With such a wing the glider, when stalled, will merely drop its nose into a steep glide and will not spin, since good lateral control at stalling speed is



TRAINER-cum-SAILPLANE. Designed and built by enthusiastic volunteers at the de Havilland factory at Toronto, Canada, this glider is intended to function as both a primary trainer and a sailplane. Its strongly designed wing has a profile with great lift coefficient, giving a lift/drag ratio of 16.

assured. Recovery will, therefore, be easy, provided the stall takes place at a reasonable height from the ground.

However, there is aways the possibility of a stall near the ground, which may be reached before the glider has had room in which to pull out of even the short and mild dive following a stall, so in order to give the pilot as much protection as possible, a cockpit encloses him. This is not only much safer than the open saddle usually employed on primary trainers, but provides better aerodynamic properties and increases the glider's performance especially when soaring flight is to be attempted.

Having in mind a towed launch by car or even by Tiger Moth, the wing has been given a greater safety factor than is usually found on gliders of this type (the ultimate load factor is 10). Its leading-edge up to the main spar is plywood covered, the rear portion being fabric covered. The wing tips have special reinforcements for handling on the ground and these also serve as protecting skids when landing.

As will be seen in the illustrations, the tail unit is carried on two spars and is of large area. Fixed surfaces are plywood covered, elevators and rudder fabric covered. Wing and tailplane are both strut-braced and wire bracing runs from the nose of the fuselage to the wing and thence to the fin.

The landing gear comprises a sprung skid under the fore part of the fuselage, immediately behind which is the single wheel, which improves take-off and simplifies handling on the ground.

The landing speed of the de Havilland glider will be 23 to 25 m.p.h., its minimum sinking speed with pilot of average weight about 2.8 ft./sec. at approximately 30 m.p.h., and the speed at the best gliding angle about 37 m.p.h.

DISPLACEMENT LIFT

Commander Campbell's Deep-sea Myth : A Sinking Ship Always Reaches the Bottom

By GRIFFITH BREWER

IN the "Brains Trust" on June 16th, Commander Campbell said that the Atlantic cable lies for the first 300 miles on the comparatively shallow bottom of the sea, but then it leaves the shelf and crosses more than 1,000 miles where the sea is 18,000ft. and where the enormous pressure of the water prevents it reaching the ground below.

The hardest thing to kill is a myth, and the older the myth the stronger it clings to life.

If Commander Campbell had attended my Roehampton Lectures 25 years ago, or if being too young to do so he had spent a shilling recently on the purchase of the Air League's 1940 reprint of the Lectures, he would have learnt that a body once submerged in water will sink and continue to sink until it reaches the bottom, no matter whether the water is shallow or is 18,000 feet deep. He would also have learnt that a sealed balloon floating in the atmosphere within range of A.A. guns could float for ever as a planet round the earth, provided you made it gastight and it was strong enough to resist expansion.

He referred to mythical ships floating about in the depths of the sea for all eternity, unable to sink to the bottom. We are indebted to Professor Huxley for his quiet branding of the Commander's belief as a superstition.

Now that so many American airmen are over here it may interest them to know that 25 years ago, when a picked selection of U.S. Army cadets from West Point came to Roehampton Royal Naval Air Station and attended the lectures, one of their number taught his English lecturer that original thoughts and theories seldom survive the test of anticipation. He answered the question set in the exam. on the principles of displacement lift correctly and then added to his answer, "This is the law of Archimedes."

This was my first intimation that I had evolved by natural reasoning what Archimedes did 2,000 years ago, and in the later editions of the Roehampton lectures I gave that ancient sage credit for his early discovery.

If battleships and aircraft had been built in Archimedes' time, he would no doubt have warned us that capital ships would be of no avail, against torpedoes launched from aircraft. It has taken 40 years for the present generation to realise this fact by painful practice and experience.

BOOK REVIEWS

"Maps and Elementary Meteorology for Airmen." By W. Myerscough. Pitman. 3s. 6d.

INTENDED chiefly for airmen who have completed their elementary training in the A.T.C., this book takes them through the more advanced requirements of the Initial Training Wing. It includes a series of sample problems in navigation with special reference to the triangle of velocities and the Mercator plotting map. Finally it refers to meteorology and its application to the altimeter and air speed indicator.

"Air Navigation for Cadets." By D. E. Webster. J. M. Dent and Sons, Ltd. 2s. 6d.

WE have lost count, now, of the number of books on air navigation which have appeared during the past six months or so. This is one more addition to their number and it runs through the usual phases of the subject—map reading, the compass, triangle of velocities and so forth, to the beginnings of meteorology. Like all its predecessors, it should fulfil its purpose admirably.

"Astro-Navigation, Part IV." By Francis Chichester. George Allen and Unwin. 4s. 6d.

THE objects of this book, which supplements the first three on the same subject by the same author, are to help an observer to learn enough of the subject for position-fixing in the air without using up too much of an instructor's valuable time, and to serve as a refresher for the man who has already mastered astro-navigation but who has not touched a sextant for perhaps two or three months; often the most brilliant mathematicians are apt to forget methods and formulæ.

The author, who is particularly well qualified to deal with this subject, has tried to cut down explanation to a minimum, but he has included the reason for performing each act since this makes it easier to remember.

Flying observers will find this book a valuable addition to their reference libraries.

"Air Pilot Training." By Bert A. Shields. McGraw-Hill Publishing Co., Ltd. 24s.

IT is claimed for this book that it is the only one on the market that covers all the essential material required for private and commercial pilot's licences. It is an American publication and it certainly embraces a wealth of extremely useful information in its four distinct parts; in fact it is really four books within one cover, the first giving an outline of the development of the aircraft from Leonado da Vinci onwards and, the theory of flight, the second deals with aircraft engines, Part III covers meteorology and Part IV air navigation.

Abundantly illustrated with photographs and line-drawings, it is simply and clearly written, and not only does it include reference to all the latest advances and improvements in aviation, but it also describes several devices still in the experimental stage.

That its contents may be confidently accepted as authentic may be gauged by the author's personal record. In 24 years as a pilot he has piled up more than 5,000 flying hours in his logbook, including military and commercial flight instruction. He has also lectured at New York University, the Brooklyn Polytechnic Institute and elsewhere.

Correspondence

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

ODDITIES

When Test-Pilots Go Visiting

WITH reference to "Oddities," John Darlington seems to think that anyone piloting a light aircraft who tells the A.O.C. of the 'drome on which he has landed that he is a well-known test-pilot must be a bit of a nit-wit. Mr. Darlington goes on to ask what would a test-pilot of great renown be doing in a Vega Gull.

Well, I expect some A.O.C.s are amused to see Mr. H. J. Penrose taxi-ing past Spitfires, etc., in a Westland Widgeon. But what does Mr. Darlington expect him to go visiting in—surely not a Whirlwind?

The Widgeon, by the way, bears the registration letters G-AAGH. W. G. H.

VAPOUR TRAILS

An Unusual Example

I SEE that interest in vapour trails has reawakened in your Correspondence columns. In case anyone is accumulating data on the subject, the following rather unusual incident may be of interest.

Date, 7.12.41. Time, around midday. Wind west, around 40 m.p.h. at ground and cloud level. Cloud, thin cumulus, 5/10 at 6,000 to 10,000ft. One Short Stirling, course south-west, height approx. 8,000ft., speed high; vapour trails were left by both starboard motors, and varied in duration from 10 to 30 secs.; a trail of irregular duration was left by the outer port motor and none by the remaining inner port motor. The aircraft was flying through banks of thin scudding cloud, but owing to the high wind it was not clear whether the local presence of cloud was associated with any variation in formation of the trails.

The figures for height, wind speed and so on were estimated from the ground. R. G. M. BULL.

Exhaust Condensation or Slipstream Turbulence?

IN the first place I would like to thank you for so generously placing space in your paper at the disposal of myself and others of your readers interested in this subject.

In the second place I must thank your readers for coming to my assistance with explanations of my observations, in particular Mr. D. H. Darbishire and Mr. G. R. de Havilland, Jr., though Mr. Darbishire's suggestion that the four trails might have been made by four single-engined planes flying in very close formation does not fit into the picture, as it is surely unusual for planes to fly in line abreast when as close together as were these four trails.

On the other hand Mr. de Havilland's own personal flying experience of these vapour trails forming from his own engine exhausts does seem to fit in, though it is conceivable also that a four-engined aircraft might also cause four trails from the turbulence caused by the slipstream from the engine nacelles, an aerodynamically imperfect surface, as suggested by Mr. Darbishire.

The suggestion that these trails might be caused by the wing tips seems to be disposed of by Mr. de Havilland's comments that they would be invisible over 5,000, and there is no doubt that the plane in question was much above that height.

I shall watch your columns with great interest for further comments on this fascinating and inspiring topic and display.

R. N. DIXON.

"G" MEN OF THE AIR

Prone Pilot's Installation Tried in U.S.A.

HAVING spent considerable time in a mock-up of a prone pilot's installation and a short time in the air in such an installation, I feel I can give at least a partial answer to the questions propounded in Mr. John Amsden's letter in your issue of March 5th.

With regard to the strain on the pilot's neck resulting from holding his head in a position to see forward, it is essential in the first place that an adequate support be provided for the pilot's head. This support should be readily adjustable to permit changes in position or to permit its being swung out of the way in combat. In the second place, the pilot will not normally keep his head raised up to look straight forward, but will instead look forward and down, assuming the installation is a reasonable one and permits of vision in this important sector.

In normal flying he will raise his head to look directly forward only from time to time. In the third place, the "pain in the neck"—which in my case was a pain in my back between the shoulder blades—tends to disappear as one becomes accustomed to the attitude.

Like many forms of sport, the prone position exercises muscles normally inactive, and some time is required for them to become accustomed to the new situation.

The problem of the rudder control is easily solved by provision of supports which move with the rudder pedals in such a manner as to support the legs at all times without interfering with the motion. In fact, the rudder control can be made extremely comfortable. In my case at least, operation of the rudder in flight was perfectly natural and required no conscious thought.

Experience with prone installations indicates rather clearly that they are quite practicable if properly designed. I have spent periods as long as four hours in such an installation without distress or fatigue more serious than I would expect from sitting in one spot for the same length of time. I have had difficulty in remaining awake under such circumstances. These "flights" were made in a mock-up, however, and the surroundings were not particularly stimulating.

CHARLES H. ZIMMERMAN.

Vought-Sikorsky Aircraft,
Stratford, Connecticut.

R.A.F. FIREMEN

Plea for Official Recognition of Their "Trade"

I AM a regular reader of your magazine and have read with intense interest the letters and appeals in your Correspondence columns. Could you possibly publish the following plea in the hope that it may come to the notice of those people who can alter the state of affairs but who cannot be approached through other channels?

The recent heavy raids on Cologne and Essen have filled the daily papers for some considerable time, and rightly, too. I am a Service fireman and, being in close contact with these operations, I can appreciate the enormous amount of organisation that made them possible.

But has anyone thought of what has happened to the man who wears the much publicised asbestos suit? The man who, to quote an article from an earlier edition of *Flight*, is very highly trained, possessing plenty of nerve, absolutely fit and not frightened of taking risks. This is true; there is plenty of danger, especially on a heavy bomber station, as a fire with a few "heavies" thrown in, combined with perhaps as many as eight petrol tanks exploding, is not a pleasant happening.

The fireman knows full well that if he enters a fire he does so without any support whatsoever, and if he meets any trouble he has to rely on his own strength and initiative to save himself from one of the most ghastly deaths that could be imagined. He has to take a course on fire-fighting and has to know how to deal effectively with every type of fire, to understand how to operate and reservice all fire equipment on the station, including the fire crash tender.

I can inform you on that subject. The fireman is just another A/C2/G.D, holding the same rank as when he was untrained and getting not a farthing extra for his work and responsibility. For some unknown reason the R.A.F. does not recognise the fireman's duties as a trade; he remains in the lowest group and has little chance of promotion owing to the establishment of the section. He has also to be A1 medically.

Does it seem fair and just that he should remain "unwept, unhonoured and unsung," without even a badge to acknowledge his calling? The "higher-ups" who fly can, I am firmly convinced, appreciate the usefulness of a crash tender standing by at the alert when taking-off and landing, both being operations with a certain amount of risk of a pile-up. Surely, then, they could bring themselves to consider us and give us as square a deal as we always give them. R.A.F. FIREMAN.

Service Aviation

CLOUDLAND STUDY : A squadron of Boston IIIs seen from the rear gun turret of the leading machine.

Royal Air Force and Fleet Air Arm News and Announcements

Awards

THE KING has been graciously pleased to approve the following awards in recognition of gallantry displayed in flying operations against the enemy :—

DISTINGUISHED SERVICE ORDER.

Sqn. Ldr. A. M. MURPHY, D.F.C., No. 161 Sqn.—This officer has carried out operations demanding the highest qualities of skill and organisation. He has, within a short period, personally organised his flight, trained his pilots and completed his tasks. He has displayed inspiring leadership.

Act. Wing Cdr. D. C. T. BENNETT, No. 10 Sqn.—One night in April, 1942, Wing Cdr. Bennett and Sgt. Walmsley were the captain and second pilot respectively of an aircraft which attacked the German naval base in the Trondheim Fiord. In spite of a fierce defensive barrage the attack was carried out at an extremely low level. The aircraft was hit by shell fire and, later, burst into flames. Wing Cdr. Bennett and Sgt. Walmsley were forced to escape by parachute, but both landed safely in occupied territory.

Both Wing Cdr. Bennett and Sgt. Walmsley displayed excellent resource and, after escaping from German soldiers and police, they eventually reached Swedish territory after a most arduous and trying journey across snow-clad mountains. Throughout, both Wing Cdr. Bennett and Sgt. Walmsley displayed courage, initiative and devotion to duty of the highest order.

Flt. Lt. R. M. CHRISTIE, R.C.A.F., No. 407 (R.C.A.F.) Sqn.—In May, 1942, Flt. Lt. Christie and P/O. Kay each led a force of bombers in an attack on a large enemy convoy, including armed ships and destroyers, off the Dutch coast. The attack, which was delivered in the fading light, was pressed home in the face of a barrage of the utmost intensity. P/O. Kay, who was first to attack, received wounds on the fingers when shrapnel tore through the floor in front of him. Despite this he flew on, firing his guns, and bombs were released on a ship almost at deck level.

Flt. Lt. Christie followed in and, releasing his bombs from mast height, scored hits on a medium sized ship. Both aircraft were damaged. That of Flt. Lt. Christie was hit in the wings, fuselage and tail, causing damage which made the aircraft exceedingly difficult to control.

P/O. Kay's aircraft was hit in both engines, while he himself received a further wound in the arm. Despite their difficulties, both these officers flew their damaged aircraft back to this country.

Some time previously, Flt. Lt. Christie participated in a daring attack on a convoy off the Dutch coast. In the face of heavy defensive fire, a large ship was bombed from only 20 feet. As the bombs exploded large quantities of debris were hurled in the air and the vessel was set on fire.

BAR TO THE DISTINGUISHED FLYING CROSS.

Act. Wing Cdr. E. D. S. SCOTT-MALDEN, D.F.C., R.A.F.V.R.—This officer has led the wing on 44 sorties over Northern France. During these operations six enemy aircraft were destroyed, one of which was shot down by Wing Cdr. Scott-Malden himself. On two occasions, in April, this officer displayed great skill when his force was attacked by superior numbers of enemy aircraft. Throughout, he has displayed great courage and leadership.

Act. Wing Cdr. R. R. O'B. HOARE, D.F.C., R.A.F.O., No. 23 Sqn.—Since being awarded the D.F.C. in May, 1941, this officer has completed some 38 intruder sorties during which he has destroyed at least three and damaged several more enemy aircraft. He has at all times set an inspiring example.

Flt. Lt. E. D. CREW, D.F.C., R.A.F.V.R., No. 604 Sqn.—Since the award of the D.F.C. in July, 1941, this officer has carried out a large number of operational patrols by night and has destroyed four enemy aircraft. He has now destroyed a total of eight enemy aircraft at night and damaged a number of others. By his readiness to fly in any weather and his skill and ability in dealing with the enemy at night, he sets a great example to the squadron.

P/O. I. C. Ormston, R.C.A.F., No. 401 Sqn., who has been awarded the D.F.C. The citation described him as having "displayed exceptional keenness to engage the enemy."

DISTINGUISHED FLYING CROSS.

P/O. F. A. KAY, R.C.A.F., No. 407 (R.C.A.F.) Sqn.—For citation see Flt. Lt. Christie.

Act. Flt. Lt. H. J. HOUGHTON, No. 107 Sqn.—In April, 1942, this officer led a formation of bombing aircraft, escorted by fighters, in a daylight raid on the marshalling yards at Abbeville. Following the attack, the formation was intercepted by enemy fighters. Flt. Lt. Houghton's aircraft was hit by bursting cannon shells which shot away the rudder, one control and trim tabs, put one engine out of action and inflicted damage on the hydraulic system.

Splinters pierced Flt. Lt. Houghton's right shoulder and arm, causing him considerable pain and discomfort. Despite this, he skilfully led his formation back to this country and made a safe landing at a coastal airdrome. This officer displayed great courage and devotion to duty. He has been engaged on active operations over a long period and has at all times displayed great skill and cool resolution in action.

P/O. W. J. DALEY, R.A.F.V.R., No. 121 (Eagle) Sqn.—P/O. Daley is an extremely keen officer who shows outstanding devotion to duty. Since February, 1942, he has completed a large number of operational sorties over Northern France, Holland and Belgium, and has destroyed at least two enemy aircraft.

P/O. A. J. HAY, R.A.F.V.R.—P/O. Hay was pilot of the Hurricane on board a ship fitted with a catapult. On the approach of enemy aircraft he was catapulted off and immediately proceeded to attack and drive off a formation of six He 111 and 115s who were preparing to deliver a torpedo attack on the port bow of the convoy. Not only did this prevent synchronisation with an attack which developed from the starboard bow, but he destroyed one He 111 and slightly damaged another.

P/O. Hay was himself wounded, and he then baled out and was picked up by one of H.M. ships of the convoy escort. He showed great gallantry, and his spirited attack was a great encouragement to all the convoy and escorts, and cannot but have been a great discomfort and surprise to the enemy.

F/O. C. A. HARRIS, R.A.F.V.R., No. 58 Sqn.—This officer has displayed gallantry and devotion to duty, and his ability as a wireless operator/air gunner has contributed largely to the successes achieved. On the ground he has set an equally fine example by his enthusiasm and his keenness to instruct junior members.

F/O. D. W. PECK, No. 103 Sqn.—F/O. Peck, as captain of aircraft, has shown great perseverance in pressing home his attacks. One night in September, 1941, when engaged in a raid on Hamburg, F/O. Peck's aircraft was heavily engaged by the ground defences and holed in many places. On the return flight, while over the North Sea, it was attacked by an enemy fighter, which F/O. Peck successfully out-manœuvred.

Act. F/O. I. P. BISHOP, No. 150 Sqn.—F/O. Bishop has participated in many successful operations against objectives in Germany and in France and the other occupied countries. His coolness and skill as a navigator, combined with courage and fearlessness, have contributed largely to the successes achieved by his squadron. When in France he took part in eight daylight sorties.

Act. F/O. G. F. GEORGESON, R.A.F.V.R., No. 12 Sqn.—F/O. Georgeson is an observer of outstanding ability. All of his operational sorties have been highly successful, and his navigation has contributed largely to the successes achieved by his squadron.

Wing Cdr. L. J. Stickley, D.F.C., Commanding Officer of a Middle East squadron, who received the O.B.E. (Military) in the Birthday Honours List.

Act. F/O. D. H. SWAN, R.A.F.V.R., No. 144 Sqn.—F/O. Swan has always completed his duties conscientiously both in the air and on the ground. He has navigated his aircraft with great skill and determination, contributing largely to the excellent results obtained.

P/O. H. COSSAR.—P/O. Cossar has participated in operations, as wireless operator/air gunner, in units equipped with Blenheim, Wellington and Stirling aircraft. He has displayed keenness and devotion to duty. On one occasion he volunteered to take part in a particularly hazardous mission, which was completed successfully.

P/O. V. V. SMITH, No. 207 Sqn.—P/O. Smith has participated in many operational sorties, including attacks against Berlin, Kiel, Brest and Mannheim. One day in October, 1941, when participating in a raid against Berlin, the aircraft was hit by anti-aircraft fire and one engine was put out of action. The extreme coolness and efficiency displayed by this officer, combined with his skilful navigation, undoubtedly saved the aircraft and the crew. P/O. Smith is a most accurate navigator, and on a recent occasion in very bad weather his navigation was particularly praiseworthy.

Her Majesty the Queen talking to aircrews during a visit with the King to a bomber station after the big raids on Cologne and the Ruhr.

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Sqn. Ldr. J. DUGDALE, R.A.F.O., No. 97 Sqn.—This officer has completed numerous operational missions, including two attacks by night on the German naval base at Trondheim in April, 1942. On the latter occasion, he commanded a formation of bombers and he played a large part in the success achieved. Recently he successfully carried out a mine-laying mission, in extremely unfavourable weather. This officer has performed excellent work and has contributed materially to the high standard of efficiency of his flight.

Act. Sqn. Ldr. H. T. GILBERT, No. 65 Sqn. (since deceased).—This officer has been engaged on operational flying since August, 1940, and fought through the Battle of Britain. He has completed numerous operational sorties over enemy-occupied territory, and although he has been shot down and wounded, he has always displayed great keenness to engage the enemy.

Since February, 1942, Sqn. Ldr. Gilbert has participated in a number of operational sorties, including an attack on German battleships. In this operation he destroyed one enemy aircraft and damaged another. He has led his squadron, and occasionally the wing, with considerable success, and his fine leadership and determination have been an inspiration to his pilots. Sqn. Ldr. Gilbert has destroyed five enemy aircraft.

Act. Sqn. Ldr. IVESON, R.A.F.V.R., No. 76 Sqn. This officer has completed many successful sorties, including two daylight attacks on Brest. During one of his night sorties, in full moonlight, he was attacked by an enemy fighter, but, by his skilful evasive action his rear gunner was enabled to destroy the attacker.

One night in April, 1942, Sqn. Ldr. Iveson was the captain of an aircraft detailed to attack the German naval base at Trondheim. He completed this mission, despite intense anti-aircraft fire and a very light sky. After dropping his bombs, he remained over the target area for some time in order to divert the fire from aircraft which were still attacking. He has displayed courage and keenness of an exceptionally high standard.

Act. Flt. Lt. A. S. R. E. ENNIS, R.A.F.V.R., No. 158 Sqn.; and P/O. A. H. HANSON, No. 156 Sqn.—One night in May, 1942, Flt. Lt. Ennis and P/O. Hanson, as pilot and rear gunner respectively of an aircraft, were detailed to carry out a low-level attack on Warnemunde. The target was heavily defended both with searchlights and anti-aircraft fire, which made a low-level attack very hazardous. Flt. Lt. Ennis, displaying great courage, flew the aircraft at a very low level, but found that he could not penetrate the heavy defences. In all, three attempts were made, before the target was reached and attacked successfully.

Throughout this time P/O. Hanson continued firing at the searchlights and other defences and destroyed at least two searchlights. The skill and courage displayed by him contributed largely to the safe return of the aircraft.

F/O. E. G. DANIEL, R.A.F.V.R.—F/O. Daniel, a night fighter pilot, has engaged raiding aircraft in all weathers, and his total of enemy aircraft destroyed has now reached five. On one occasion he encountered a BR.20 well to the south of Malta and, pursuing it, he eventually shot it down in flames a short distance from the Sicilian coast. One night in May, 1942, he accomplished a fine feat by shooting down three BR.20s.

Act. F/O. A. ABELS, R.A.F.V.R., No. 35 Sqn.—F/O. Abels has participated in many successful sorties, including two daylight attacks on the German battleships which were at Brest. One night in April, 1942, as the navigator of an aircraft detailed to attack the German naval base at Trondheim, he navigated the aircraft safely over the North Sea and mountainous country of Northern Norway and arrived over the target at the appointed time. The attack was made from a very low level, which necessitated the most accurate map reading. F/O. Abels, despite intense opposition, completed this duty most successfully. He has displayed courage and skill of a high standard.

P/O. G. SWEENEY, R.A.A.F., No. 9 Sqn., and Act. F/O. A. R. TETTENBORN, R.A.F.V.R., No. 9 Sqn.—As captain and navigator of aircraft respectively, P/O. Sweeney and F/O. Tettenborn carried out a low-level attack on an aircraft factory at Warnemunde one night in May, 1942. Skilfully avoiding the beams of a large number of searchlights in the target area, P/O. Sweeney pressed home his attack and released his bombs on two buildings around which aircraft on the ground were dispersed, and on three nearby sheds.

The aircraft was flown so low to ensure accuracy that some of the air crew thought it was on fire as it passed over the smoke and flames caused by the explosions. Little damage was sustained, however, and the aircraft was flown safely to base. Throughout the operation both P/O. Sweeney and F/O. Tettenborn displayed perfect teamwork, great skill and undaunted courage.

P/O. G. GARDINER, R.C.A.F., No. 35 Sqn. (since reported missing).—P/O. Gardiner was the captain of an aircraft detailed to attack the German naval base at Trondheim on two nights in April, 1942. These flights each involved many hours' flying time and covered a distance of about 1,350 miles over the North Sea and mountainous country of Norway. Despite intense opposition, P/O. Gardiner pressed home his attacks and returned to base safely. He has displayed outstanding airmanship, courage and devotion to duty which have been an inspiration to other members of the squadron.

Wing Cdr. K. V. GARSIDE, No. 230 Sqn.—This officer has served with the squadron for the past 2½ years. He has completed over 100 sorties, in-

VIATION

eluding attacks on enemy submarines at night. In one of these attacks his aircraft came under the enemy's machine-gun fire whilst flying at a low level. Wing Cdr. Garside has performed much valuable work both operationally and in the training of new pilots.

Act. Sqn. Ldr. P. E. LEWIS, No. 407 (R.C.A.F.) Sqn.—This officer has shown great perseverance in pressing home his attacks against enemy ships, at mast-head height, in the face of anti-aircraft fire from the ships and shore batteries. He has destroyed one enemy aircraft and has damaged five enemy vessels. As flight commander, his keenness, energy and leadership have contributed largely to the remarkable successes achieved by his squadron.

Flt. Lt. J. R. H. MEREFIELD, R.A.F.V.R.—This officer has carried out important long-distance reconnaissance flights with highly successful results. He has displayed great skill and determination.

Flt. Lt. D. N. MILLIGAN, No. 230 Sqn.—This officer is a most courageous and determined pilot. He has completed a large number of sorties, and, on three occasions when his flying boat developed engine failure, his superb airmanship was responsible for the safe return of his aircraft. On the first occasion one of the engines shed its propeller and then caught fire. Although the aircraft was vibrating badly (making it impossible to read the instrument panel), and despite bad weather, Flt. Lt. Milligan succeeded in landing his heavily laden aircraft safely.

Two days later he experienced another engine failure, but he succeeded in reaching his base, where he made an emergency landing without the aid of a flare path.

In March, 1942, whilst taking off from Malta during a heavy raid, a large bomb burst close to his aircraft. The explosion apparently affected the port engine cowling, for, after about an hour in the air, the main cowling became partially adrift, causing the aircraft to lose height. Flt. Lt. Milligan regained control and completed his flight safely. On each of these occasions this officer has magnificently overcome extremely severe tests.

Act. Flt. Lt. W. BRADSHAW, No. 240 Sqn.—This officer has shown himself to be outstanding in every respect. He has made a number of flights of long duration. In August, 1941, he remained in the air for 27 hours in search of an enemy ship, and in October, 1941, he completed an anti-submarine sweep and convoy escort, during which he made an attack on an enemy submarine.

F/O. F. A. ARTHUR, R.A.A.F., No. 70 Sqn.—F/O. Arthur is an extremely efficient and skilful bomb-aimer. He has also proved himself to be an expert on astro-navigation. He has achieved some excellent results, notably when he obtained hits on an oil storage plant at Piræus and on an ammunition dump in an El Adem-Acroma area. Apart from his operational work, F/O. Arthur has devoted much of his spare time in imparting his knowledge to new observers. He has displayed a high standard of devotion to duty.

F/O. J. R. COCKTON, No. 11 Sqn.—As an observer this officer has participated in 80 operational missions, involving sorties in Syria, Iraq and Libya. He has shown great keenness and determination.

F/O. H. H. K. GUNNIS, R.A.F.V.R., No. 252 Sqn.—This officer has proved himself to be a fine fighter pilot. Whilst flying on naval protection duties he has often shown determination and bravery in the face of the enemy. He shot down one and probably destroyed a further two hostile aircraft on one operation, and continued to harass the enemy by making feint attacks after his ammunition was expended.

On a more recent escort duty, F/O. Gunnis again destroyed one and possibly another two enemy aircraft. His main thought has been to devote his whole attention to the task of protecting the convoy or naval force.

F/O. J. B. JEWELL, R.A.A.F., No. 10 Sqn.—F/O. Jewell has been responsible for the training and efficiency of the squadron observers, a duty which he has completed successfully. His keenness and devotion to duty have contributed largely to the navigational successes achieved by his squadron. He was the bomb-aimer who secured a success against an enemy tanker in December, 1941.

Act. Sqn. Ldr. S. B. GRANT, No. 249 Sqn.—This officer is an excellent fighter pilot. On one occasion he led a force of fighter aircraft over many miles of sea into Malta. On the same day, after his aircraft had been refuelled, he took off and destroyed a Junkers 88. For the rest of the day he remained at the head of his squadron in a series of fierce battles over the island. He has destroyed at least four enemy aircraft and damaged many more.

Flt. Lt. H. L. NORTH, No. 457 (R.A.A.F.) Sqn. (since missing).—This officer has commanded a flight since the squadron was formed. He has performed much valuable work both during the training of the squadron and in its operational activities. Displaying great courage and initiative, Flt. Lt. North, who previously served with another unit and fought in the Battle of Britain, has destroyed at least five enemy aircraft.

Act. Flt. Lt. H. A. S. JOHNSTON, R.A.F.V.R., No. 126 Sqn.—One day in April, 1942, Flt. Lt. Johnston showed great courage and initiative when, after a prolonged fight against a numerically superior force and having expended all his ammunition, he carried out a series of successful feint attacks on Me 109s to allow his squadron colleagues to land safely. Flt. Lt. Johnston has destroyed at least three hostile aircraft and damaged several more.

Brig.-Gen. James Doolittle, winner of the Schneider Trophy Contest 17 years ago and now making daylight bombing raids on Japan.

Act. Flt. Lt. W. A. LAURIE, R.A.V.F.R., No. 222 Sqn.—This officer has completed over 70 sorties over Northern France. He has at all times displayed great courage, determination and leadership.

Act. Flt. Lt. W. G. LOCKHART, R.A.F.V.R., No. 161 Sqn.—This officer recently completed operations involving much preparation and difficult organisation. Flt. Lt. Lockhart worked hard to achieve success and surmounted many difficulties with great skill and initiative.

F/O. G. A. F. BUCHANAN, R.A.F.V.R., No. 249 Sqn.—This officer has displayed great determination in his encounters with raiding aircraft. One day in April, 1942, he shot down a Ju. 87 and damaged another in one combat. Having expended all his ammunition, he carried out a series of feint attacks on Me. 109s and drove them away from some of his comrades who were coming in to land their aircraft.

P/O. L. P. GRIFFITH, R.N.Z.A.F., No. 485 (N.Z.) Sqn.—P/O. Griffith has participated in 70 sorties over Northern France. He has always shown the greatest keenness and enthusiasm, setting a fine example to his colleagues. He has led his flight on several occasions.

P/O. P. A. NASH, No. 249 Sqn (since deceased).—Whilst operating from Malta, this officer has shot down ten raiding aircraft. Six of these he destroyed within a period of three days. P/O. Nash, who has displayed high courage and devotion to duty, has destroyed at least 12, and damaged several more enemy aircraft.

W/O. R. J. EMBERO, R.C.A.F., No. 175 Sqn.—This pilot has undertaken numerous bombing and fighter sorties over occupied territory and has proved himself to be an excellent section leader, who, by his keenness and courage, inspires confidence in his fellow pilots. In April, 1942, he led a flight against two enemy destroyers, one of which he hit, in spite of heavy anti-aircraft fire, and left in a badly damaged condition. He has also shot down an enemy aircraft.

DISTINGUISHED FLYING MEDAL.

Sgt. H. WALMSLEY, No. 10 Sqn.—For citation see Wing Cdr. Bennett.

Flt. Sgt. J. W. YARRA, R.A.A.F., No. 185 Sqn.—This pilot has shot down four enemy aircraft in air battles. On one occasion, when protecting a rescue launch in the face of numerous enemy aircraft, he shot down one Messerschmitt and probably destroyed another. When his ammunition was exhausted he made feint attacks and kept the enemy at bay for threequarters of an hour.

Flt. Sgt. R. L. STILWELL, R.A.F.V.R., No. 65 (East India) Sqn.—This airman is a fine leader and an inspiration to his squadron. Since August, 1940, he has been engaged on active operations and has taken part in many sorties over enemy occupied territory, during which he has destroyed one enemy aircraft and damaged others. In August, 1941, he reported the exact position of a R.A.F. bomber crew whom he had sighted in the sea 15 miles off the Dutch coast. The information he gave was responsible for their final rescue.

In April, 1942, when returning from a sweep, he sighted a pilot in the sea without a dinghy, and, although Flt. Sgt. Stilwell was short of fuel, he succeeded in dropping his own dinghy within 25 yards of the spot. Unfortunately, the pilot was afterwards found to be dead.

Flt. Sgt. G. J. STRUTT, R.C.A.F., No. 58 Sqn.

Sgt. K. W. CRAIG, R.C.A.F., No. 58 Sqn.—Flt. Sgt. Strutt and Sgt. Craig were captain and second pilot respectively of an aircraft recently engaged on an anti-submarine patrol in the Bay of Biscay. A U-boat was observed surfaced on the sea, and, under the direction of his captain, Sgt. Craig immediately attacked the submarine from a height of about 40 feet.

The attack was carried out with such speed and skill that the explosives detonated before the U-boat had time to submerge completely. At least one charge exploded alongside the hull. The submarine came to the surface for a few moments and then submerged at a steep angle, and a large patch of oil and very large air bubbles appeared. The success achieved reflects the greatest credit on both these airmen.

Sgt. H. E. BATCHELDER, No. 102 Sqn.—In May, 1942, Sgt. Batchelder was the captain of an aircraft detailed to attack Mannheim. Shortly after crossing the Dutch coast, on the outward journey, the aircraft was damaged by enemy shell-fire, but the journey was continued and the target bombed. On the return journey, one engine failed to function, but height was maintained. After crossing the Dutch coast, the aircraft was attacked by an enemy fighter.

Skilfully handling his damaged aircraft, Sgt. Batchelder outmanœuvred his attacker and enabled his own gunners to deliver accurate bursts of fire. The enemy fighter was seen diving away steeply, and, it is believed, it was destroyed. Sgt. Batchelder then flew on to this country and made a skilful landing in difficult circumstances. Throughout, this airman displayed great skill, courage and coolness.

Tea up. A tea wagon—given by Americans and operated by the Y.M.C.A.—arrives at a dispersal point on a Halifax station.

SERVICE AVIATION

Flt. Sgt. C. A. LIVINGSTONE, No. 608 Sqn.—This airman has completed 28 operational sorties. Many of these have been carried out in extremely adverse weather. In the last few months, Flt. Sgt. Livingstone has achieved much success in his attacks on enemy shipping. He has succeeded in scoring hits on no less than three heavily escorted vessels. As captain of aircraft, he has shown a strong sense of responsibility, great courage and devotion to duty.

Flt. Sgt. A. R. ROBSON, R.N.Z.A.F., No. 485 (N.Z.) Sqn.—Flt. Sgt. Robson has completed 32 sorties over enemy occupied territory. From the start he has shown both courage and determination in his desire to engage the enemy. He has destroyed one and probably destroyed another hostile aircraft.

Sgt. A. P. GOLDSMITH, R.A.A.F., No. 126 Sqn.—This pilot has destroyed at least five enemy aircraft. On one occasion he dived through a strong enemy fighter screen to destroy a bomber. When engaged by the fighters he shot one of them down.

Roll of Honour

Casualty Communiqué No. 137.

THE Air Ministry regrets to announce the following casualties on various dates. The next-of-kin have been informed. Casualties "in action" are due to flying operations against the enemy; "on active service" includes ground casualties due to enemy action, non-operational flying casualties, fatal accidents and natural deaths.

Royal Air Force

KILLED IN ACTION.—Sgt. E. G. S. Gould; Sgt. J. D. Hawkins; Flt. Sgt. A. B. Horn; Sgt. G. F. Johnston; Flt. Sgt. L. A. Owens, D.F.M.; Sgt. K. L. Thomas; Act. Sqn. Ldr. M. D. H. Wilson.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. J. D. Anderson; P/O. D. U. Barnwell, D.F.C.; Sgt. W. A. Blackburn; Sgt. E. Fieldsend; Sgt. E. J. R. Fowler; P/O. C. A. C. Havelock; P/O. W. H. Hughes; Sgt. E. W. Ireland; Sgt. S. Johnson; Sgt. G. A. Painting; Sgt. E. G. Knight; P/O. G. K. K. K. Pelmore; Sgt. J. D. Pugh; Sgt. J. Rooney; Sgt. W. Rutherford; Sgt. H. Shuttleworth; P/O. C. J. C. Walker; Sgt. P. C. Williams.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. J. Ahern; Sgt. W. E. Austin; Sgt. F. A. Axe; Sgt. V. E. Baker; Sgt. K. M. Bird; F/O. P. A. Bitmead; P/O. W. H. Budd; Sgt. N. J. Bull; Sgt. J. R. Carney; Sgt. D. T. Clark; Sgt. W. N. Collins; Sgt. S. A. McC. Crothers; Flt. Sgt. K. Crouch; Sgt. G. H. Dartnall; P/O. A. J. Dearden; Flt. Sgt. M. S. Dudier; Sgt. S.C. Edwards; Sgt. W. R. Furzey; Sgt. E. F. G. Gill; F/O. R. H. Gordon, D.F.C.; Flt. Sgt. G. C. P. Haines; P/O. D. A. Halsall; P/O. A. C. L. Hodge; Sgt. G. M. Holstead; Sgt. J. W. Horrocks; Sgt. A. W. Humphries; Flt. Sgt. A. G. C. Hunter; Sgt. J. St. G. Johnston; Sgt. J. Kyle; Act. Wing Cdr. F. A. G. Lascelles, D.F.C.; Flt. Sgt. J. W. Lucas; Sgt. T. P. MacHale; Sgt. D. W. Marshall; Sgt. R. Murphy; Flt. Sgt. J. R. Noble; Flt. Sgt. A. J. Park; Sgt. T. A. Peters; Flt. Sgt. D. F. Pickerill; P/O. J. H. Richardson; Sgt. C. D. Rose; Sgt. J. F. Skingsley; Flt. Lt. A. J. C. Simpson, D.F.C.; P/O. P. R. Smith Sgt. L. Stock; Sgt. G. E. Warren; Flt. Sgt. C. P. Weir; P/O. H. V. Wilgar-Robinson; Sgt. E. I. C. Wood.

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED IN ACTION.—Sgt. T. McNeill.

WOUNDED OR INJURED IN ACTION.—Sgt. G. Edmund; Flt. Lt. S. E. Goddard; Flt. Lt. P. Nixey; Sgt. W. F. Perkins; Sgt. D. H. L. Smith; Sgt. D. N. Southey.

DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—Sgt. F. Woodfield.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. V. C. R. Baker; Sgt. R. B. Blatchley; P/O. P. R. S. Brooke; Sgt. A. Burns; Sgt. P. J. Coleman; Sgt. E. F. Collins; Sgt. V. R. Dufton; Sgt. R. H. Emery; Sgt. P. A. G. Finch; Sgt. R. Freak; Sgt. E. Hainsworth; Sgt. F. G. Huntley; Sgt. R. Jacques; Sgt. D. M. Laing; Sgt. C. V. Maddock; Flt. Sgt. G. H. Mays; Sgt. W. L. Mogford; Sgt. A. Naylor; Wing Cdr. R. Sawrey-Cookson, D.S.O., D.F.C.; P/O. G. G. Soames; Sgt. D. P. Stock; Sgt. L. E. Taylor.

MISSING.—Sqn. Ldr. A. P. Burdett; Flt. Sgt. M. Bunting; Sgt. S. Burtwell; Sgt. S. Davis; Sgt. H. Downs; Sgt. J. C. Dunn; Sgt. S. Elmes; Flt. Sgt. E. H. Erby; Sgt. R. O. Francis; Act. Flt. Lt. A. J. Love; P/O. A. MacTaggart; Sgt. A. S. Marley; Sgt. D. C. Martin; Sgt. G. E. Newman; Sgt. A. E. Rees; Sgt. E. G. W. Shotter; Sgt. V. L. Stephens; Sgt. H. M. Tapley; Sgt. K. H. Tibbatts; Flt. Sgt. H. E. D. Tilby; Sgt. J. Walker; Sgt. P. Wood.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—Sgt. A. G. Mackinnon.

KILLED ON ACTIVE SERVICE.—L.A/C. J. H. Attwood; P/O. M. H. Ball; L.A/C. T. D. Bower; L.A/C. F. C. Cannings; Sgt. E. Coleman; Sgt. S. A. Coleman; Sgt. V. G. Deacon; L.A/C. M. D. Ellis; Sgt. H. W. Everett; Sgt. F. A. Fairclough; Sgt. W. F. Good; A/C.1 J. D. Greenard; L.A/C. W. J. Hawes; P/O. G. R. Heppell, D.F.M.; L.A/C. S. F. Hoskins; Sgt. S. H. Kittson; P/O. J. R. Lee; W/O. G. E. Leeke; A/C.2 W. McElhutton; Sgt. R. W. Marshall; Flt. Lt. C. J. S. Metford; Cpl. J. Pitt; Flt. Sgt. S. W. Pook; Act. Flt. Lt. F. R. Povey; Sgt. H. Shaw; Sgt. W. A. Skinner; Cpl. D. L. Wills; Sgt. L. J. Wilson; Sgt. W. Wilson; L.A/C. P. W. Winter.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Flt. Sgt. E. W. Berriedale-Johnson; L.A/C. P. Bond; Sgt. E. A. Hafner; Sgt. B. Jepson; Flt. Sgt. H. R. Main; Flt. Sgt. E. V. Message; Sgt. C. L. Naylor; Sgt. J. E. Stoddart; Sgt. G. R. Stookes; Sgt. H. Tweedie; Flt. Sgt. B. Yeadon, D.F.M.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. C. W. Almond; Sgt. R. E. Arnold; A/C.1 L. W. Bayley; Sgt. F. W. Church; L.A/C. R. A. G. Cleave; A/C.2 G. C. G. Cross; Sgt. W. A. C. Dickinson; A/C.1 W. G. Richardson; P/O. R. G. C. Rusbridge; Sgt. A. Smith; Sgt. H. Tattersfield.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Act. Sqn. Ldr. F. J. Austin; Sgt. W. B. Cooper; A/C.2 J. Crabtree; L.A/C. J. W. Cutler; Act. F/O. M. I. Davies; Sgt. R. Hulme; L.A/C. J. Somerville.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—Sgt. G. H. Elliott; P/O. G. L. Gosnell.

DIED ON ACTIVE SERVICE.—A/C.2 G. R. Butler; A/C.1 C. V. Fairweather; Sgt. A. T. G. F. Gibson; Cpl. S. G. Glen; Sgt. H. R. Harvey; L.A/C. G. D. Hastie; L.A/C. S. Heald; Cpl. P. J. McVeigh; A/C.2 T. J. Malone; A/C.1 F. McGrath; A/C.1 T. Robson; A/C.1 E. D. Rudd; A/C.2 C. Storer; A/C.2 W. Turner; A/C.1 A. M. Williams.

Amendment to Casualty Communiqué No. 129.

Under the heading KILLED ON ACTIVE SERVICE: For Act. Flt. Lt. J. D. W. H. Clutterbuck, D.F.M., read Act. Flt. Lt. J. D. W. H. Clutterbuck. For Sgt. T. E. Coogan read Sgt. T. E. Coogan, D.F.M.

Amendment to Casualty Communiqué No. 131.

Under the heading PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED IN ACTION.—For Sqn. Ldr. W. A. A. De Freitas read Wing Cdr. W. A. A. De Freitas.

Royal Australian Air Force

KILLED IN ACTION.—Sgt. W. A. Allen; Sgt. T. E. Pollock; Sgt. C. J. W. Reed; Sgt. K. D. Riordan.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. R. J. Bell; Sgt. G. N. Church; Act. F/O. J. Kinnane.

MISSING.—P/O. B. J. Halse; Sgt. L. W. Hanson; Sgt. L. D. Orbuck.

KILLED ON ACTIVE SERVICE.—Sgt. J. A. McNamara.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. P. Spackman; Sgt. A. G. White.

The signalman. A control officer at a bomber station checking off his list of departures. Only strict adherence to carefully made time-tables enable operations of the magnitude of the Cologne raid to be carried out.

Royal Canadian Air Force

KILLED IN ACTION.—P/O. H. P. McKee.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. E. D. Ozment.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. J. B. Anderson; Sgt. J. S. Calderwood; Sgt. L. J. George; Flt. Sgt. E. O. Grimsdick; Sgt. J. J. Kelly; Sgt. A. P. McLean; Flt. Sgt. B. P. O'Neill; Sgt. J. D. Robertson; P/O. D. Schafheitlin.

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED IN ACTION.—Sgt. J. H. G. Matthews.

WOUNDED OR INJURED IN ACTION.—P/O. L. H. Lecraw.

MISSING, BELIEVED KILLED IN ACTION.—Act. F/O. G. E. Mitchell, D.F.M.

MISSING.—Act. Flt. Lt. E. D. Baker; P/O. N. F. Bowsher; Flt. Sgt. W. J. Cadger; Flt. Sgt. S. S. Dawes; Flt. Sgt. L. W. Fletcher.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—Sgt. R. G. Smith.

KILLED ON ACTIVE SERVICE.—P/O. J. F. Anderson; Act. Flt. Lt. W. H. Fetherston; Sgt R. St. J. Gregory; Act. Sqn. Ldr. J. McCormack; P/O. J. E. Piggott; P/O. L. B. Sceales; Sgt. W. J. Stevenson; Sgt. B. W. Taylor.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. L. R. Brunette; P/O. A. J. Jodoin.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. E. C. Evans.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—Sgt. R. S. Daniel; Flt. Sgt. G. R. Foster; Flt. Sgt. A. Moran; Sgt. W. J. Oxendale.

Royal New Zealand Air Force

KILLED IN ACTION.—Sgt. K. W. Brett; P/O. E. P. Smith.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. H. J. Grut; Sgt. R. A. Hamilton.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. A. J. Higgison; P/O. M. S. Lund; Sgt. E. B. Whitaker; Sgt. F. L. R. Wood.

MISSING, BELIEVED KILLED IN ACTION.—P/O. W. F. Budge.

KILLED ON ACTIVE SERVICE.—Flt. Sgt. D. L. C. Liddell.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Sgt. J. R. Harvey.

South African Air Force

KILLED ON ACTIVE SERVICE.—Lt. G. de V. Leach.

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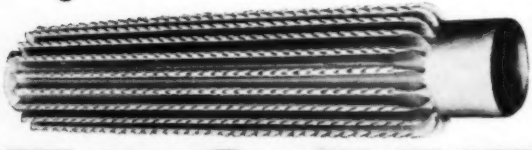

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Air boat towed for four days

A SUNDERLAND flying-boat forced down by engine trouble in the South Atlantic was towed by a corvette for 74 hours through severe storms and reached its base in West Africa unharmed, it was revealed yesterday.

Hundreds of miles were covered, says an Air Ministry bulletin.

Here is a log of the journey as reported by the flying-boat's captain, Flight-Lieut. P. N. B. Parsons:—

1st DAY.—On escort duty when engine trouble developed. Managed to alight near corvette and signal for tow. Rope broke twice; second time as heavy sea got up at dusk.

Rainstorms

First night was the worst; strong wind with several rainstorms and lightning.

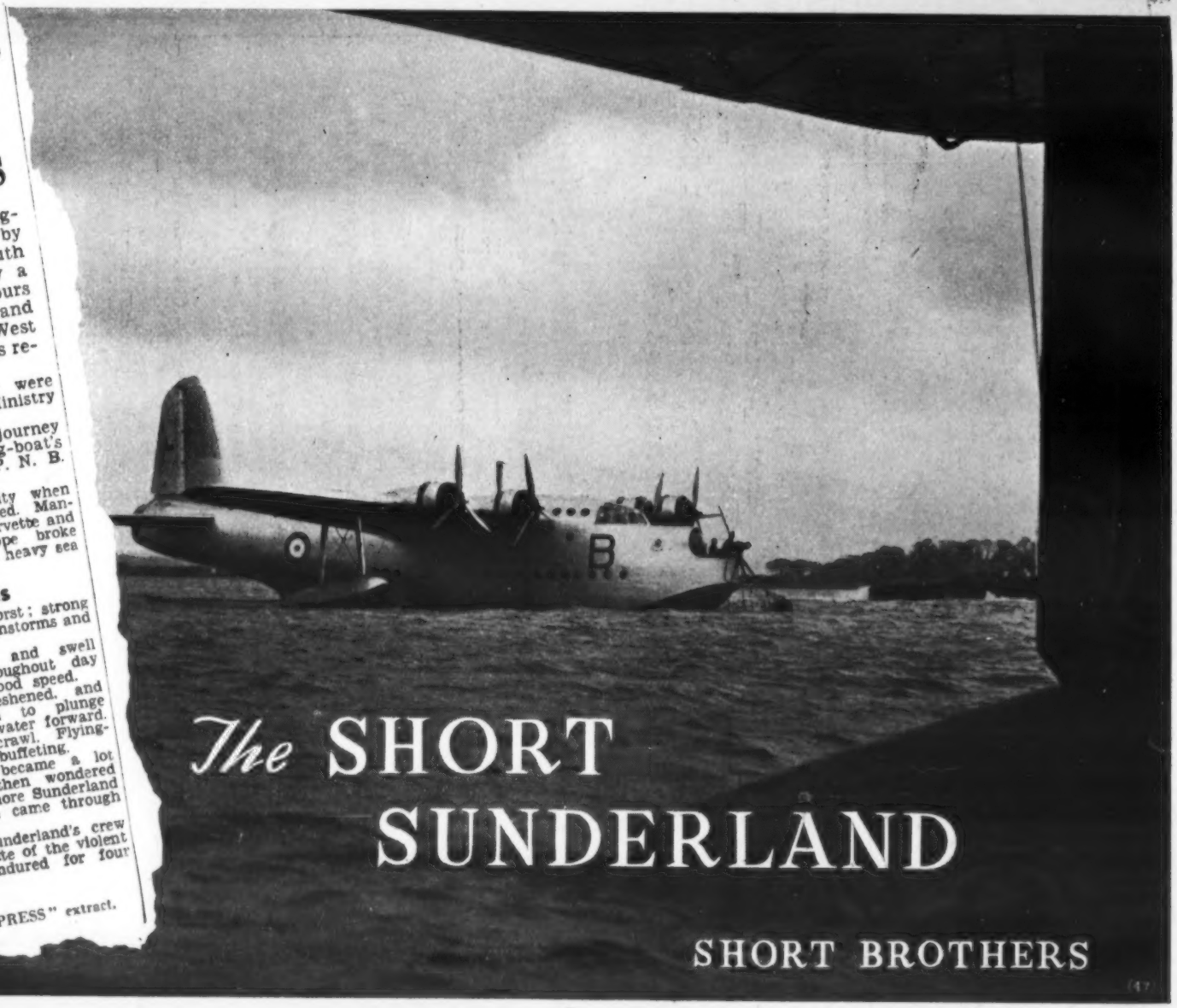
2nd DAY. — Wind and swell dropped, and throughout day and night made good speed.

3rd DAY.—Wind freshened, and Sunderland began to plunge heavily, shipping water forward. Speed reduced to crawl. Flying-boat took terrific buffeting.

4th DAY.—Going became a lot easier, but by then wondered just how much more Sunderland would stand, she came through splendidly.

None of the Sunderland's crew was injured in spite of the violent buffeting they endured for four days.

"SUNDERLAND EXPRESS" extract.



"FLIGHT" Photograph.

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Your worn-out TYRES, TUBES, INSULATED CABLE, MATS, FLEXIBLE PIPING are wanted to help replace lost sources of supply — now!

The enemy now holds 90% of the world's natural rubber resources. That is why every scrap of rubber lying useless and discarded all over the country is wanted for war purposes — at once!

Organise a ruthless search — indoors and out — for waste rubber. Keep it up, week after week, until the war is won.

Do more. See that from now on, you and everyone in your employ economise in the use of rubber: *that not a scrap is ever wasted, thrown away or burnt.*

CHECK OVER THIS LIST

Here is a number of important items made of rubber. Check them over when you are searching out your waste rubber for salvage.

BATTERIES • BATTERY BOXES
BELTING • DE-ICERS
DRAUGHT EXCLUDERS • EBONITE FITTINGS • ELASTIC ROPE
ENGINE MOUNTINGS • FLEXIBLE PIPING • FLYING CLOTHING
INSULATED CABLE • INSULATING MATERIALS • MATS
RUBBER COVERED CONTROLS
RUBBER PROTECTED PETROL TANKS • SOUND PROOFINGS
TYRES • TUBES • UPHOLSTERY (pneumatic, sponge & rubberised hair)

HOW TO HAND IN YOUR RUBBER

1 WORN-OUT TYRES & TUBES. Take them to a local garage for dispatch to an Official Government Depot; or put them out for collection by the Local Authority.

2 ANY WASTE RUBBER. Put it out for collection by the Local Authority; or if you have a large amount for disposal you may sell it to a Merchant. If you don't know the nearest Merchant's address, write to **Rubber Control, (W.R.), Empire House, St. Martin's le Grand, London, E.C.1.**

3 If you accumulate more than one ton, you can obtain a *special collection* by getting in touch with the nearest Demolition and Recovery Officer. If you don't know his address, write to **The Ministry of Works & Buildings, Lambeth Bridge House, Albert Embankment, London, S.E.1.**

CARRY ON THE GOOD WORK Continuous salvage effort is vital. Salvage builds up our strength from within and frees shipping space. So carry on the good work and put out for collection still more

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2 THE FULL USE OF OUR EXPERIENCE IN IMPROVING QUALITY & OUTPUT, REDUCING WASTE AND TEACHING THE 'KNOW HOW' TO NEW MEN & WOMEN.
3 THE ELIMINATION OF LOST TIME EXCEPT IN CASE OF ILLNESS.
Signed by:-
For MAIN MACHINE SHOP.
For THE NIGHT SHIFT.
For THE PUMP SHOP.
For THE AERO FITTING SHOP.
for TOOLROOM, EXPERIMENTAL, VIEWERS & ALL OTHERS.
THE MANAGEMENT PLEDGES
1 ALL OUR TIME, ENERGY & RESOURCES TO WIN THIS WAR.
2 A FAIR AND SQUARE DEAL TO OUR MEN IN ALL MATTERS
3 A FAIR WAGE IN RETURN FOR MAXIMUM OUTPUT
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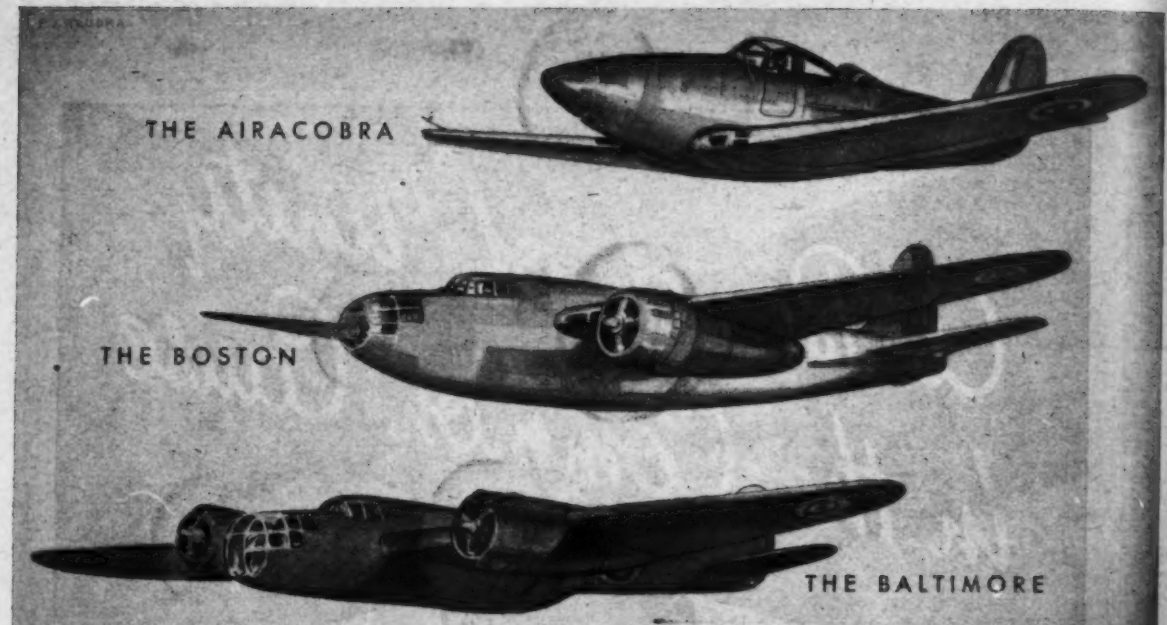

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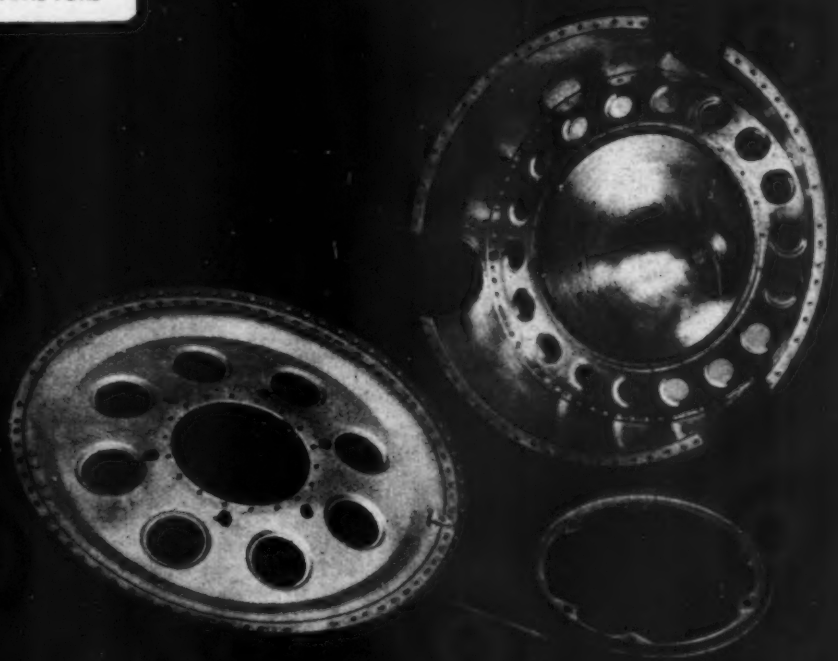

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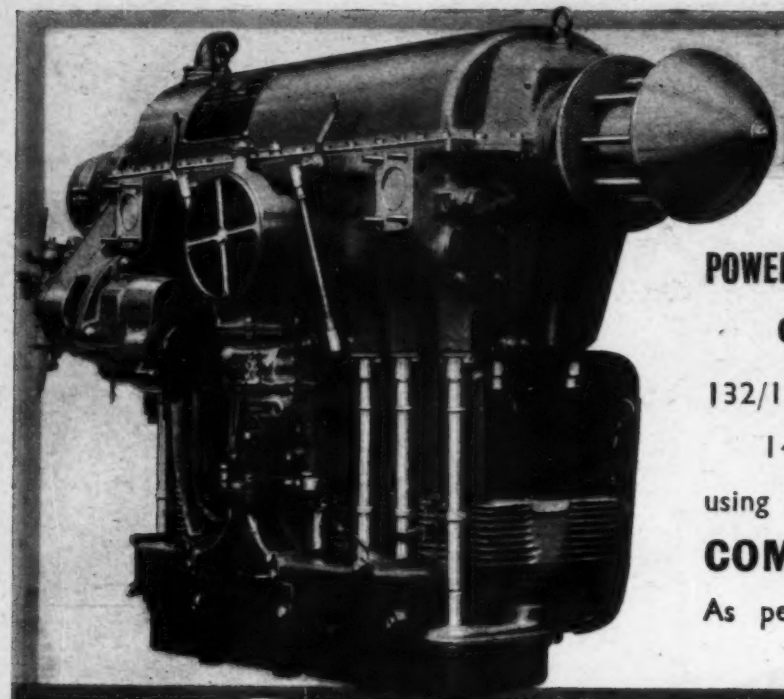

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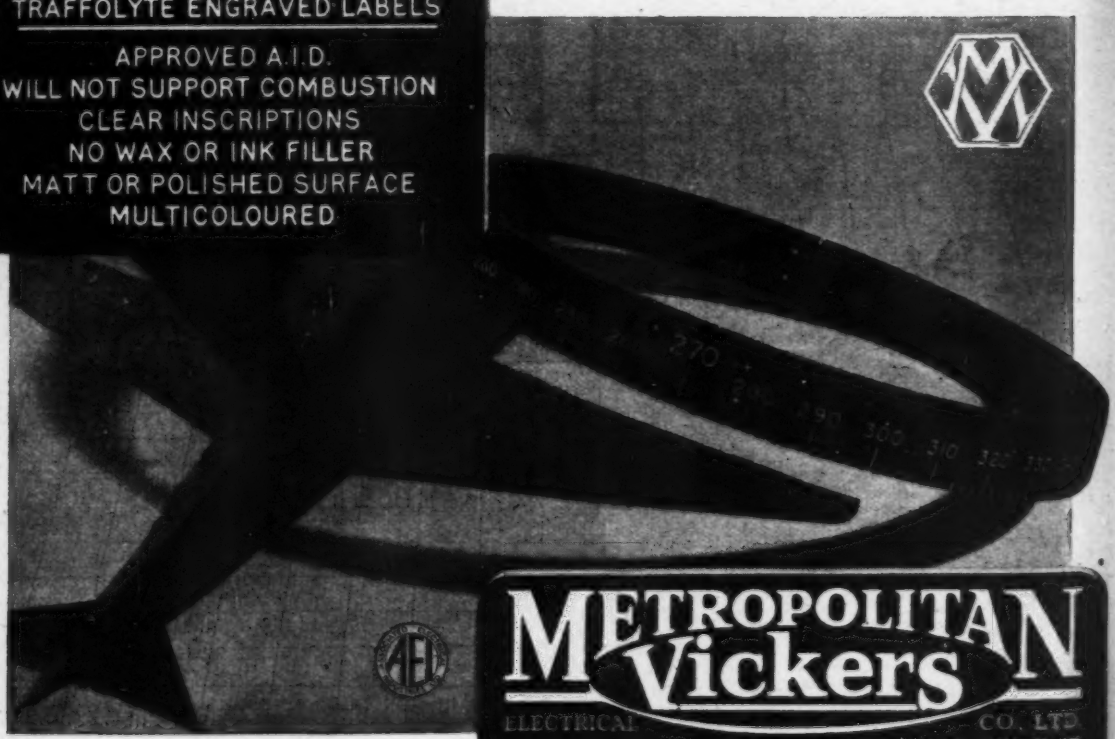

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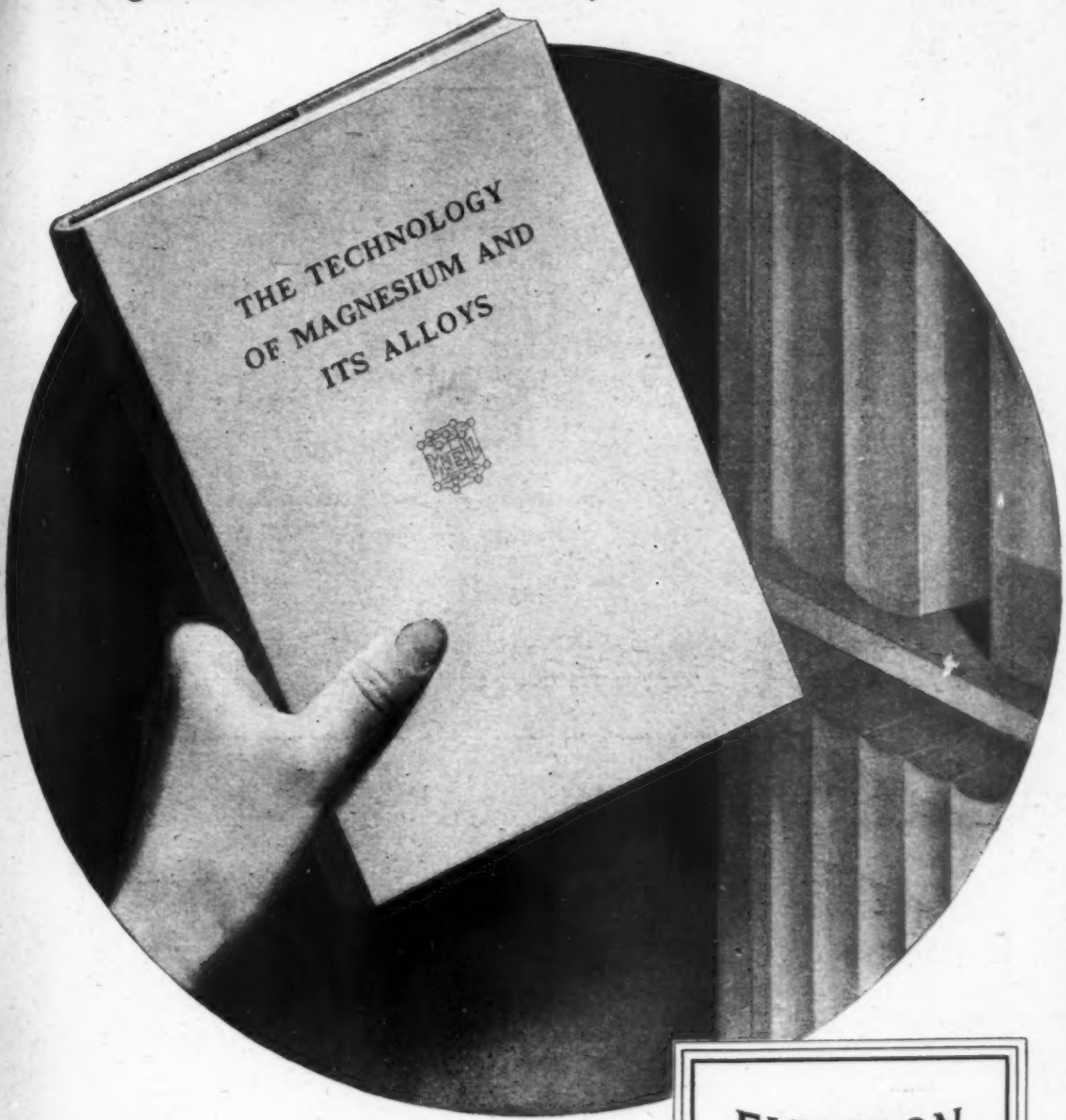

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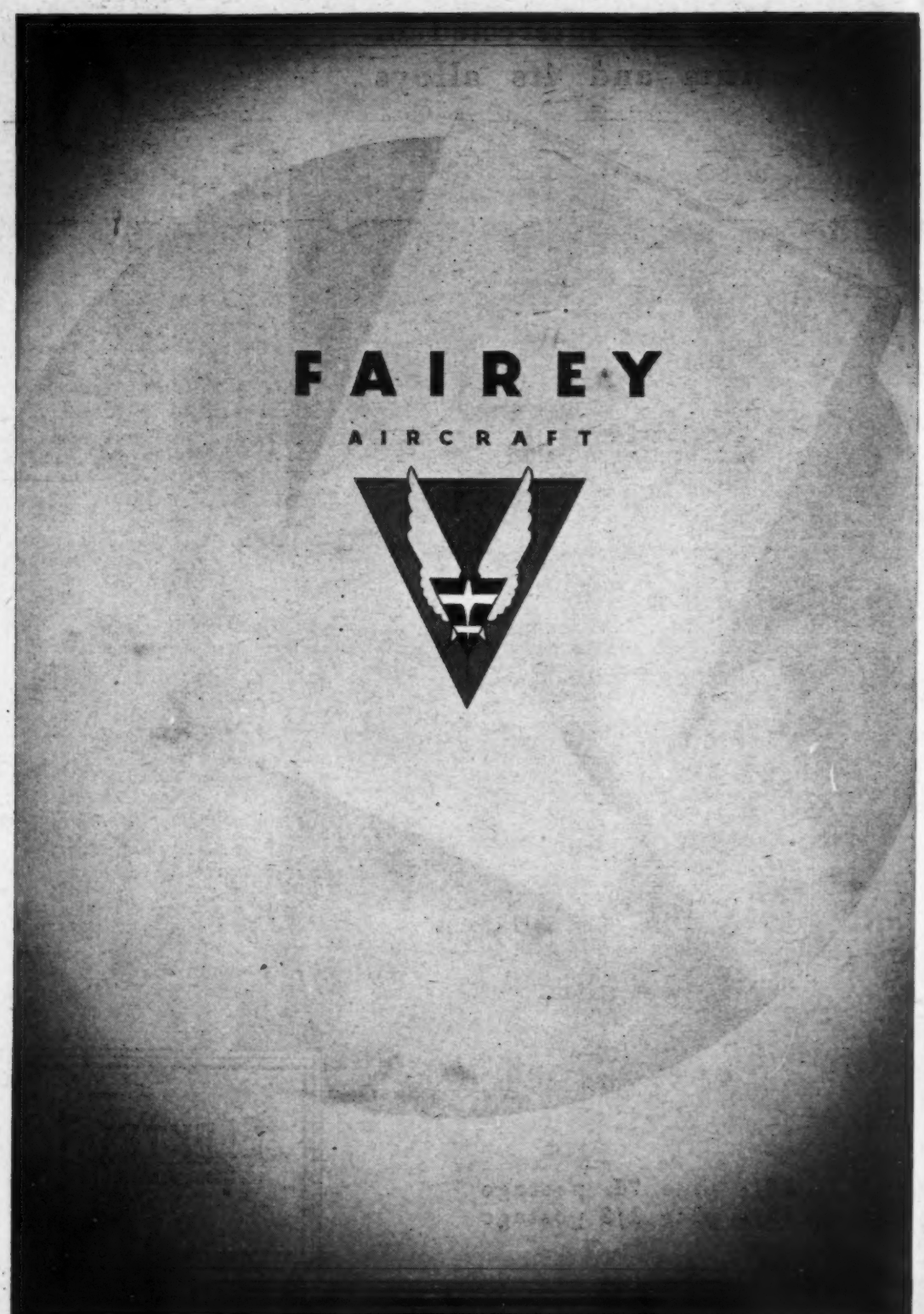
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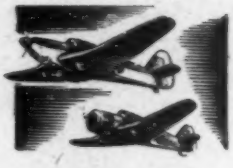

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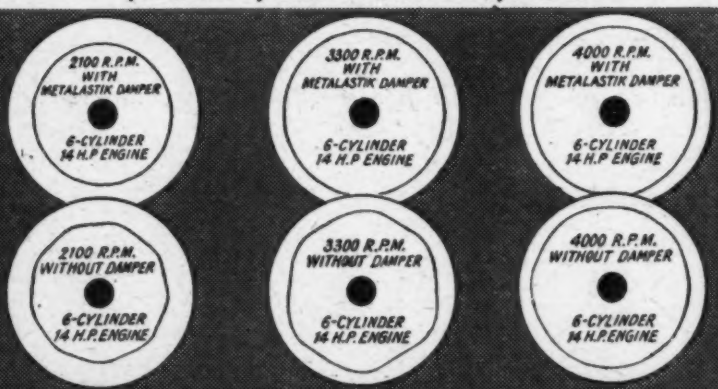
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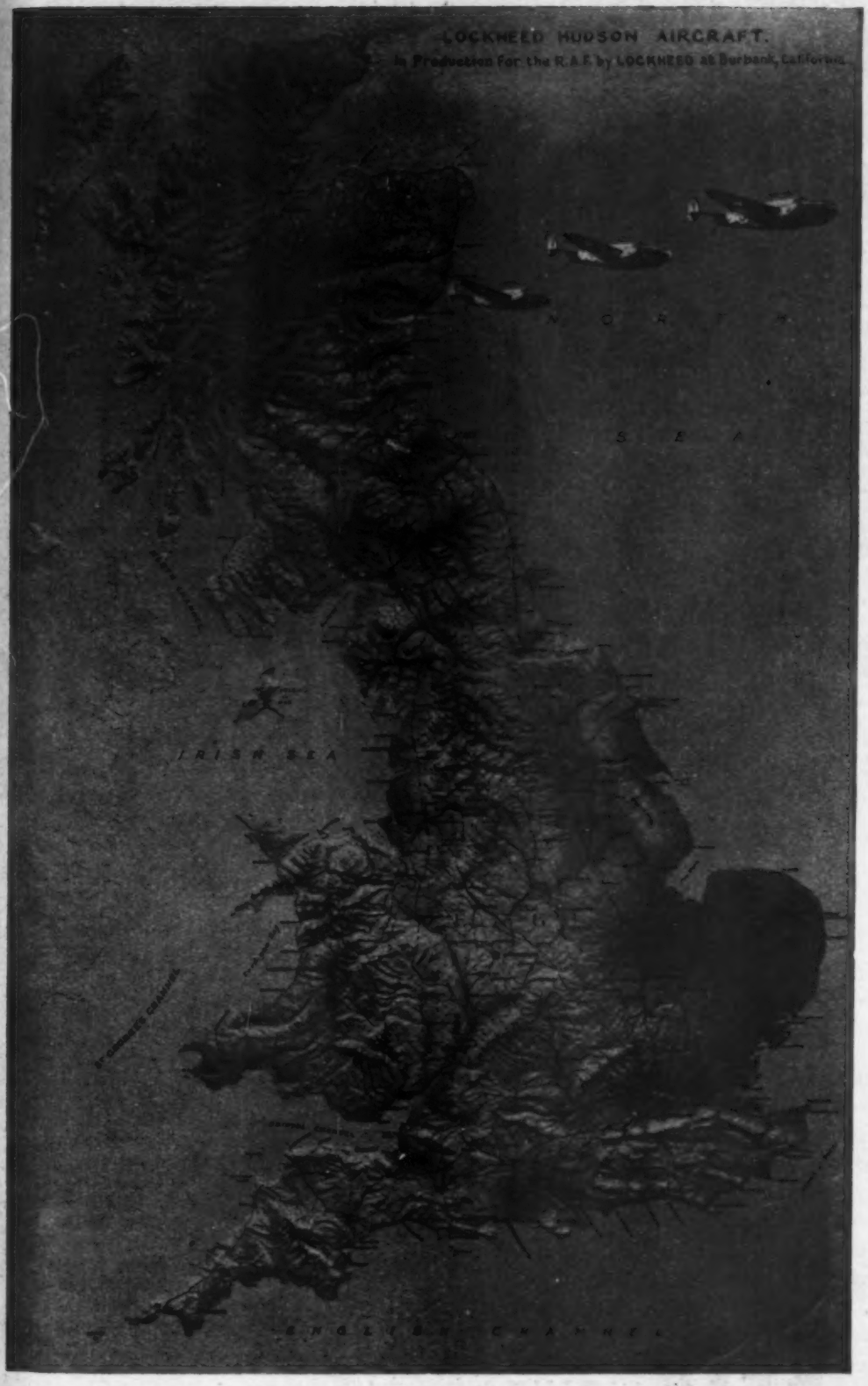
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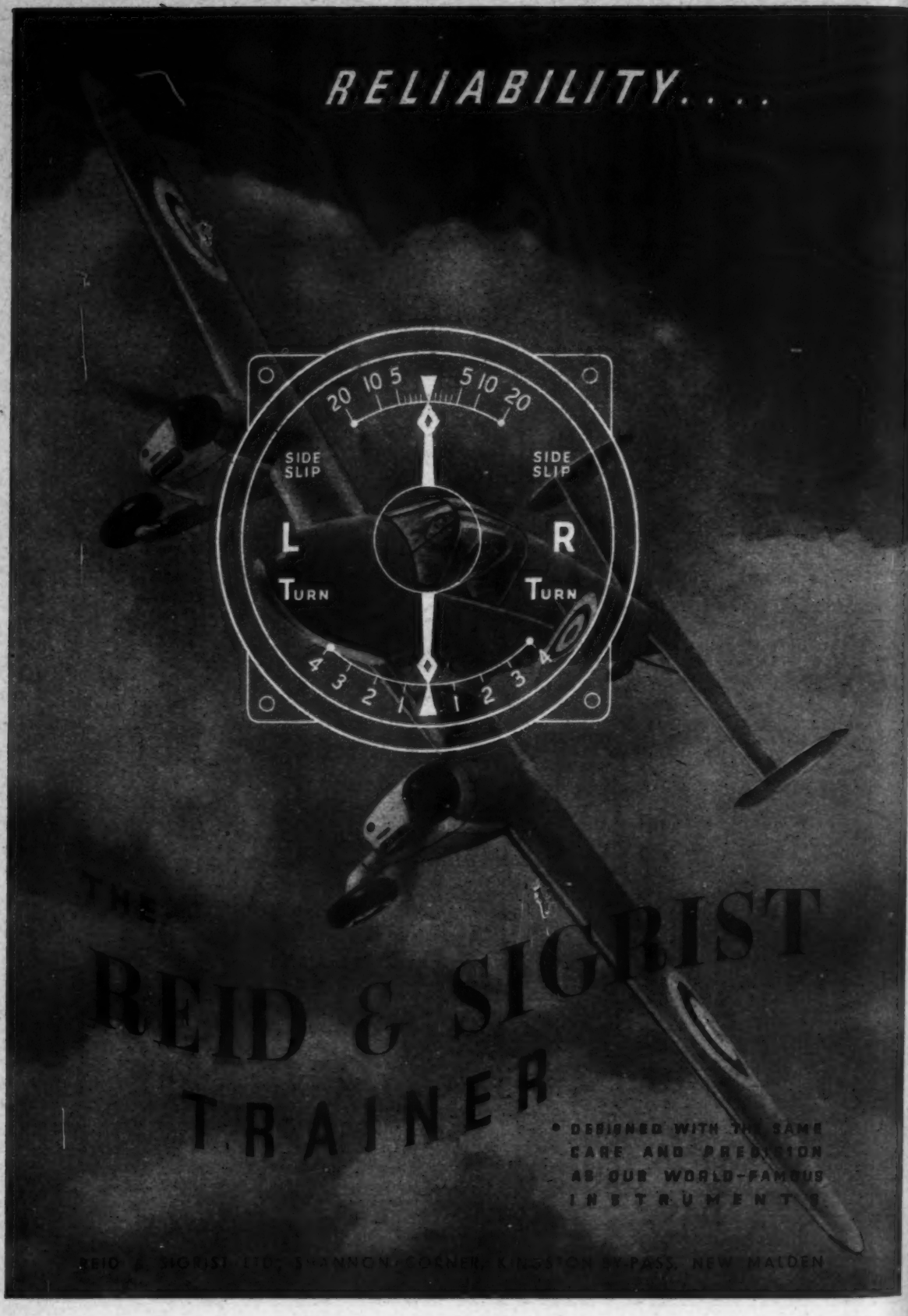
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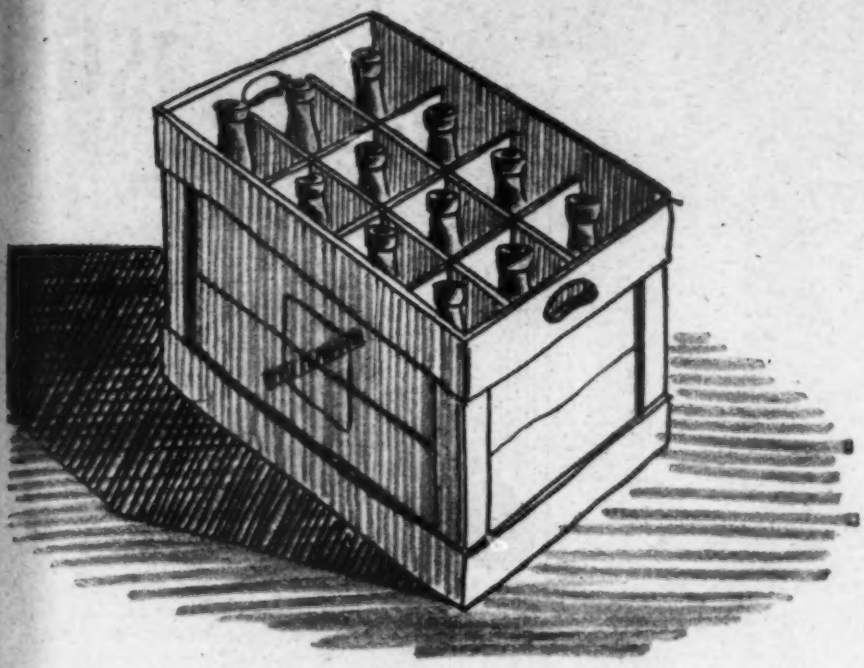

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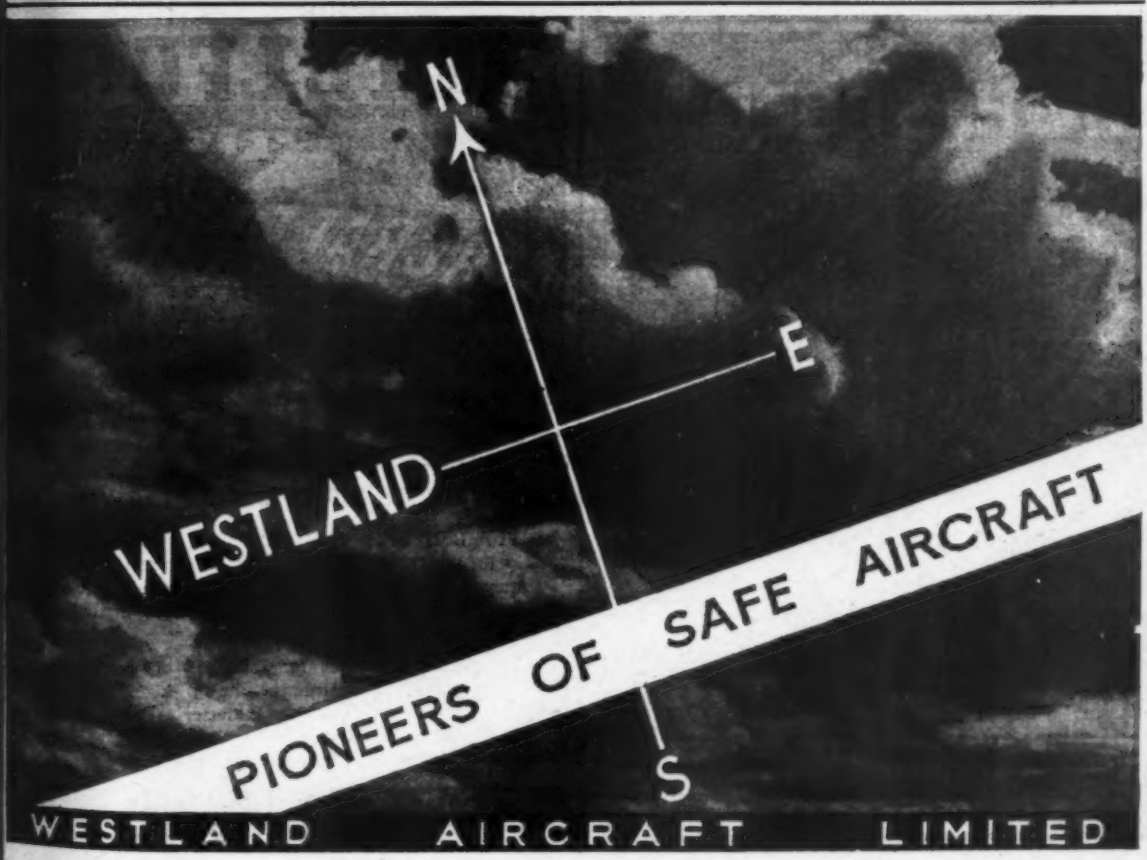

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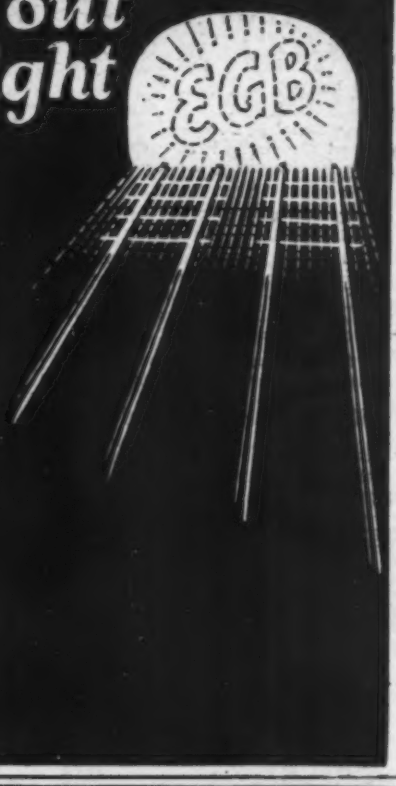

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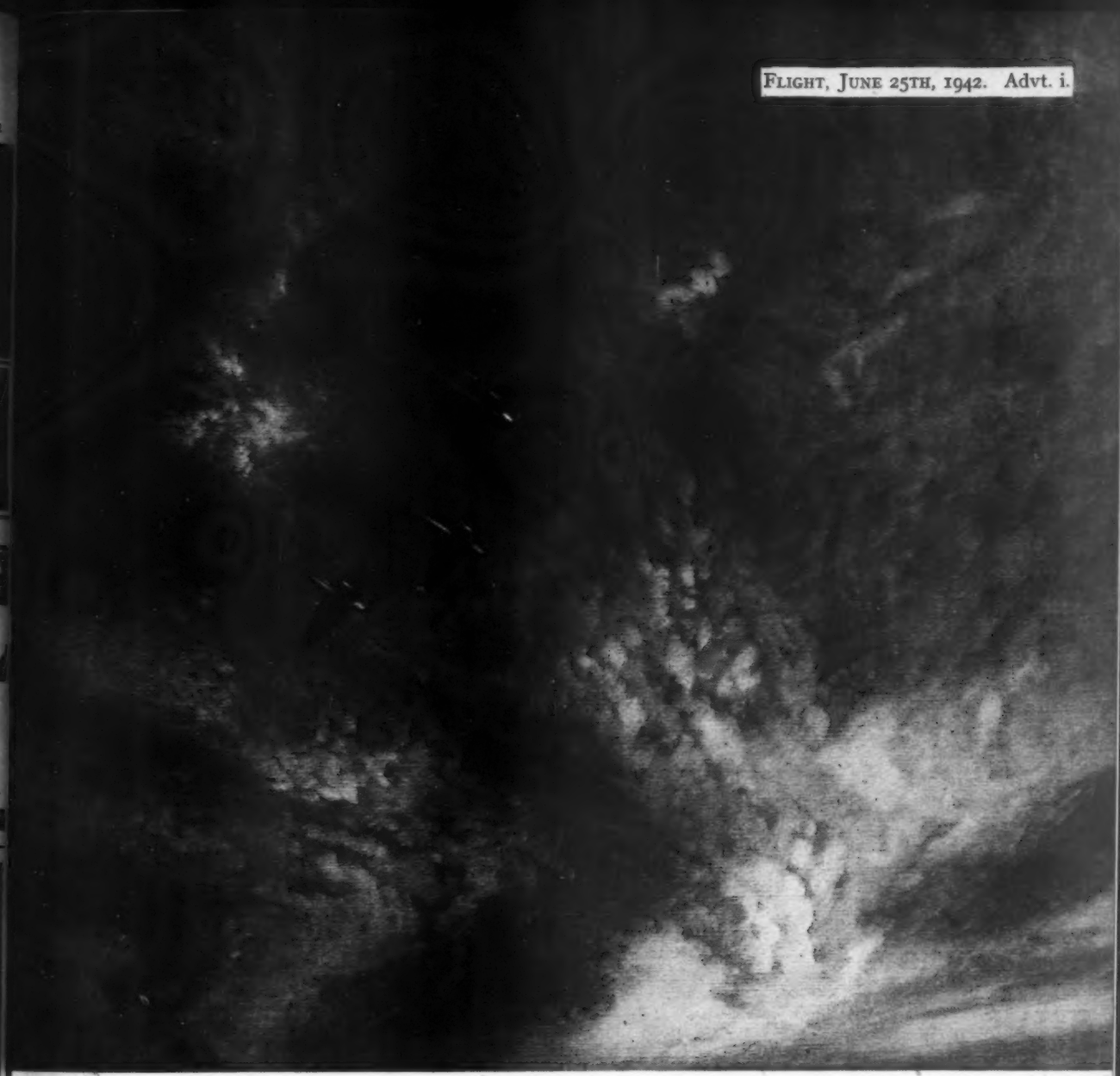

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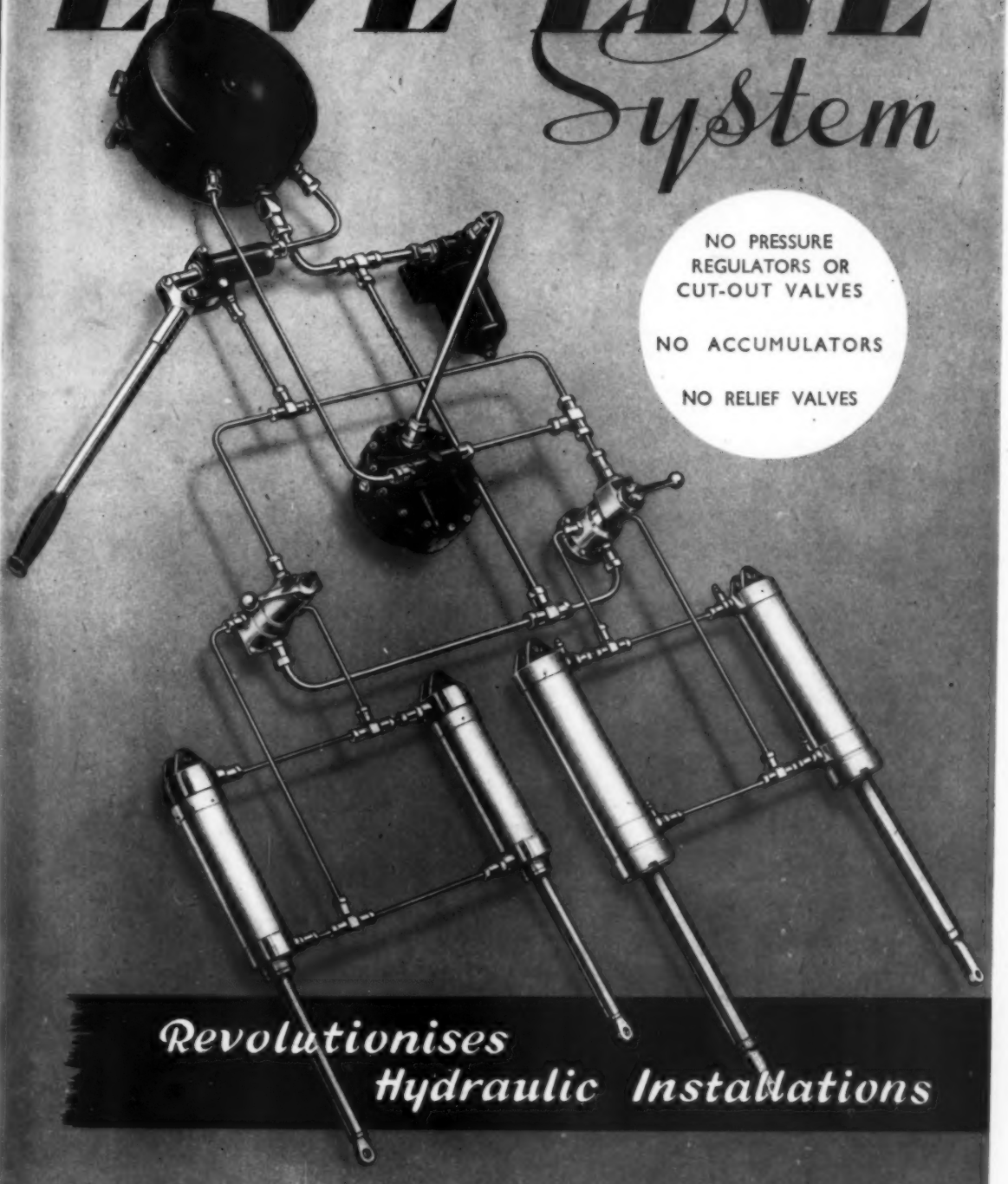

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